THE GENUS ERYTHRONIUM: A TAXONOMIC AND DISTRIBUTIONAL STUDY OF THE WESTERN NORTH AMERICAN SPECIES

Elmer Ivan Applegate

It seems likely that the ancestral home of the genus *Erythronium* was far to the north. Through southerly migration we now find the species widely spread, quite encircling the land area of the north temperate zone. Not only have they thus become separated, but they are now more or less completely isolated between sea, mountain, and desert barriers. Whatever their progenitors were like, and however they reached their present habitats, they have accommodated themselves to the varying conditions along the way, and for a long time have been adapting themselves to their present environment. The Old World species, although most widely dispersed east and west, appear to be much alike, and on the whole apparently more closely allied to the eastern North American species than to our western forms. The western North American species, although having the most restricted lateral distribution, are by far the greatest in number, and show the most divergent range of differentiation. Of the Eurasian group, only three or four species have been generally recognized. The genus extends westward from Japan through Formosa, northern Mongolia, southern Siberia and Russia, and central Europe to the Pyrenees Mountains. In North America the species are divided by the Rocky Mountains into two well defined groups. East of this range they are widely distributed throughout the United States and southern Canada, some five species being listed. From the Rocky Mountain region westward to the Pacific, I am including fifteen species and three subspecies or varieties. Thus there seem to be at least two dozen known species in the world, as against from a dozen to fifteen heretofore listed. With the extension of more systematic work, probably other species will be added. Within the *Erythronium* range of central Asia are vast unexplored regions where it is likely that in the future new species will be found. If the western situation as I found it is any criterion, some revision may be found necessary not only in eastern North America, but possibly in Europe.

The present paper deals with the western North American species embraced within the region of the Rocky Mountains and westward to the Pacific Ocean. It is based upon a detailed and critical field study covering practically the entire range of all of the known forms, and extending over a period of a dozen years. The specific areas investigated include southwestern Alberta, southern British Columbia, Washington, Oregon, California, Idaho, Montana, Colorado and Utah. *Erythronium* has not been found in Nevada, Arizona and New Mexico. While nearly all of the forms had been collected, so imperfectly were

they known, that a number of new ones had long been erroneously referred to published species, the feeling among botanists in general being that no new species were likely to be found. Heretofore no attempt has been made to work out the various forms in the field. Not since 1891, the date of Watson's[1] revision, has any kind of comprehensive treatment of the North American species been published. Dr. Watson had little field knowledge of the western species. His descriptions for the most part were based upon herbarium material and incomplete notes of local collectors. With such inadequate material, he himself expressed hesitancy in proposing his revision.

My interest in *Erythronium* dates back to my boyhood home in the Siskiyou Mountain region of southwestern Oregon. This is the very center of the *Erythronium* world. Over one third of the known species are concentrated within the limits of the old cretaceous "Siskiyou Island" of southwestern Oregon and northwestern California. This is a region of many interesting endemics, and the meeting place of plants from widely separated sections. Here, while a student of botany at Stanford University, my first *Erythronium* collections for scientific purposes were made in 1895. Other collections were made in the same region and in the Cascade Mountains of Oregon during the seasons of 1897–'98, at which time I was acting as assistant to Dr. Coville, botanist of the U. S. Bureau of Plant Industry. It had become increasingly evident that the only way to know these interesting plants was to visit them in their native haunts. Not until many years later was I in a position to take up the work in earnest. The initial investigation was undertaken in the Siskiyou Mountains and southern Cascades of Oregon in 1921, and concluded in the Rocky Mountains in 1933. All descriptions were drawn in the field from the living plants. The geographic distribution has been worked out from my own extensive travels, and from the examination of a large number of collections, from those of the earliest botanical explorers on. The trails of most of these have been followed throughout the west. Nearly all of the types have been examined, and most of the type localities have been visited. The western universities and other schools and institutions having plant collections were also visited, where all *Erythronium* material was examined and botanists consulted concerning them. The work of preparing the manuscript for publication was done at the Dudley Herbarium of Stanford University.

The pursuit of these elusive and strikingly beautiful plants furnished a rare opportunity for the indulgence of an innate liking for wilderness wandering. In nearly all of these delightful ramblings, my wife was my constant and helpful companion.

In the examination of specimens, I have had the use of the

[1] Watson, Sereno. A Revision of the American Species of *Erythronium*. Proc. Am. Acad. 26: 125–130. 1891.

collections from the following herbaria, each designated in citations by initials:

Dudley Herbarium of Stanford University, California (DH)
University of California, Berkeley (UC)
California Academy of Sciences, San Francisco (CA)
University of Oregon, Eugene (UO)
Oregon State College, Corvallis (OS)
Willamette University, Salem, Oregon (WU)
University of Washington, Seattle (UW)
Washington State College, Pullman (WS)
University of Idaho, Moscow (UI)
University of Montana, Missoula (UM)
Montana State College, Bozeman (MS)
University of Wyoming, Laramie (UWy)
University of Colorado, Boulder (UCo)
Colorado State College, Ft. Collins (CS)
University of Utah, Salt Lake City (UU)
University of British Columbia, Vancouver (BC)
Provincial Museum, Victoria, Vancouver Island (PM)
(All of the foregoing were visited).
Gray Herbarium, Cambridge, Mass. (GH)
National Herbarium, Washington, D. C. (US)
Philadelphia Academy of Sciences, Philadelphia, Pa. (PhA)
New York Botanical Garden, New York City (NY)

I take this opportunity to thank those in charge of the herbaria named above, as well as many others, both here and abroad, who have assisted me in this work; and I wish especially to express my appreciation to Dr. L. R. Abrams, Professor of Botany at Stanford University, for much helpful advice and encouragement.

Key to the Western Species of Erythronium

Leaves not mottled, bright yellow-green; flowers white, creamy-white, or golden-yellow. Essentially of the high mountains (Canadian and Hudsonian zones), but descending into the yellow pine regions (Transition Zone) east of the Cascade Mountains ..... Section Concolorae

Stigma entire or nearly so.

Style short, strongly clavate; flowers white or creamy-white.

Perianth segments without appendages, narrow. Sierra Nevada and Cascade Mountains of California ..... 1. *E. purpurascens*

Perianth segments with appendages, broader. Cascade Mountains of southern Oregon, and Siskiyou Mountains of northern California and southern Oregon ..... 2. *E. klamathense*

Style long, filiform; flowers golden-yellow.

Perianth segments without appendages; anthers red. Sawtooth Mountains of Idaho ..... 3. *E. nudopetalum*

Perianth segments with appendages; anthers golden-yellow; plants propagating by clump-forming offsets ..... 4. *E. tuolumnense*

Stigma definitely lobed, the lobes at length recurved; style long, usually not strongly clavate.

Flowers golden-yellow.

Anthers red. East side of the Cascade Mountains to the Rocky Mountain region ..... 5. *E. grandiflorum*

Anthers white; filaments of irregularly unequal length in each set. Northern Rocky Mountain region westward to the coast ranges ..... 5a. *E. grandiflorum* var. *pallidum*

Anthers golden-yellow; style often stouter and stigma lobes shorter. Central Rocky Mountain region and southward; locally in northern Idaho .. 5b. *E. grandiflorum* subsp. *chrysandrum*

Flowers white.

Anthers white; leaves usually oblanceolate. Along the border of Idaho and Washington ..... 6. *E. idahoense*

Anthers golden-yellow; leaves lanceolate, commonly abruptly narrowed to a distinct petiole. High Cascade, Olympic, and British Columbia coast mountains ..... 7. *E. montanum*

Leaves mottled, that is, the green to dark brown upper leaf surface divided into irregular areas by lighter colored lines; flowers white or creamy-white, pink or lavender, never golden-yellow; the colored segment bases usually broken by splotches or transverse bands. Essentially of the lowlands and foothills. Transition Zone ..... Section Pardalinae

Stigma entire or nearly so; style short and strongly clavate. Southwestern Oregon and northwestern California.

Flowers white or creamy-white.

Segments without appendages..... 8. *E. Howellii*

Segments with appendages ..... 9. *E. citrinum*

Flowers lavender, segment bases dark purple ..... 10. *S. Hendersonii*

Stigma plainly lobed; style long and filiform; segments with appendages.

Filaments strongly dilated.

Flowers rose-pink. Near the coast from northern California to British Columbia ..... 11. *E. revolutum*

Flowers white or creamy-white. West of the Cascade Mountains.

Anthers golden-yellow. Mostly from central Oregon northward to British Columbia ..... 12. *E. oregonum*

Anthers white. From central Oregon southward to Rogue River ..... 12a. *E. oregonum* subsp. *leucandrum*

Filaments filiform. California.

Stem branching above the leaves; stigma lobes stubby.

Anthers white. Sonoma and Lake counties northward to Humboldt and Trinity counties	13. *E. californicum*
Anthers golden-yellow; plants propagating by sessile offsets. Mt. St. Helena region, Napa, Lake, and Sonoma counties	14. *E. helenae*
Stem branching at the leaves; stigma lobes long and filiform; propagating by long underground runners. Foothills of Sacramento and San Joaquin valleys	15. *E. multiscapoideum*

1. Erythronium purpurascens S. Wats. Proc. Am. Acad. 12: 277. 1877. *Erythronium grandiflorum* var. *multiflorum* Torr. Pac. R. R. Rep. 4: 146. 1867. *Erythronium purpurascens* var. *uniflorum* S. Wats. Bot. Cal. 2: 171. 1880.

Corms commonly 3–4 cm. long, 5–6 mm. thick, sometimes retaining the remains of old ones for several years; leaves bright yellow-green, 10–15 cm. long, 1–2 cm. broad, usually lanceolate to linear-lanceolate, acuminate (the larger sometimes obtuse), rarely oblanceolate, narrowed to a short, narrowly winged petiole; scape frequently slender and weak, sometimes more or less flexuous or tortuous, 5–20 cm. high, or higher; flowers small and delicate, often several to many on short slender pedicels, sometimes the uppermost longer, perianth segments usually linear-lanceolate, 10–15 mm. long, 2–4 mm. broad, bluntish, white with plain pale yellow base, those of the inner set entirely naked; filaments filiform, short (4–5 mm.); anthers white, at least twice the length of the filaments before dehiscence; style yellow, short, 4–5 mm. long, clavate; stigma very shortly to obscurely lobed or notched; capsule oblong-obovoid, blunt, 2–3 cm. long, 7–8 mm. thick.

This is the smallest and most delicate flowered of our western species. It flowers immediately after the disappearance of the snow, following the retreating drifts. The tendency of the perianth segments to turn pinkish or purplish with age or in drying is unusually marked.

Distribution: Canadian and upper Transition zones, in meadows, along streams in openings in coniferous woods. Usually found in rather small colonies, these often widely separated, especially southward. Southern Cascade Mountains from Mt. Lassen southward through the high Sierra Nevada to Mt. Moses, Tulare County, California. More common throughout the greater part of the upper drainage area of Feather River, which covers most of Plumas County, in well watered volcanic soil of good depth; increasingly rare southward in the older, glaciated and more precipitous high Sierra Nevada, where soil and moisture conditions are less favorable. Separated from *E. klamathense* Applegate, its nearest ally, by the Pit River and Klamath River gaps on the north, and from the Siskiyou region to the westward by the valley of the upper Sacramento River.

Apparently never intimately associated with either of the other two species of the range; although in the valley of the north fork of Yuba River, its lower limits nearly coincide with the upper range of *E. multiscapoideum* (Kell.) Nelson & Kennedy, which finds its way up through the yellow pine belt. With more detailed exploration in Tuolumne County, it may be found at or near the upper limits of *E. tuolumnense* Applegate.

Specimens collected. Upper Kings Meadow, Mt. Lassen region, Shasta County, 20 June 1929, *5772;* Drakesbad, Warner Valley, Mt. Lassen region, Plumus County, 21 June 1929, *2802.*

Specimens examined. California. Shasta County: Lassen Peak, August 1896, *Mrs. Austin 531* (UC); 7 July 1897, *M. E. Jones* (DH); Kings Valley, 3 August 1896, *Mrs. Austin* (US); Soupan Springs, June 1903, *Hall & Babcock 4294* (US, GH, NY, UC). Plumas County: Indian Valley, 1875, *J. G. Lemmon 627* (UC); Massac Creek, 18 June 1919, *W. W. Wagner 260* (DH); Crystal Lake, 25 May 1920, and Greenville, 3 April 1920, *Mary Clemens* (CA); near Long Valley, 15 June 1927, *Alice Eastwood 14534* (CA, NY); Lake Center, 15 July 1921, *Anna Head* (CA); Drakesbad, Mt. Lassen, June 1927, *Mrs. Sutliffe* (CA); Feather River Meadows, April 1897, *Mrs. R. M. Austin 906* (US); July 1911, *W. W. Eggleston 7241* (US); Hotspring Valley, *Jepson 4079* (US); without definite locality, 1872, *Mrs. M. E. P. Ames* (US), 1874 (GH), without date (GH, NY); *Mrs. Austin* (US), 1876–7 (GH). Lassen County: Big Meadows, April 1878, *Mrs. R. M. Austin 287* (UC). Tehama County: Lassen Butte, August 1912, *Alice Eastwood* (CA); Dry Lake, 13 July 1911, *W. W. Eggleston 7210* (US, NY). Sierra County: Cedar Glen, 25 May 1920, *V. Jones* (CA); Lusk Meadows, July 1918, *Mrs. Sutliffe* (CA); Downieville, 21 May 1853–4, *J. M. Bigelow* (PhA, GH, US, NY, the last the type of *E. grandiflorum* var. *multiflorum* T. & G.); hills near Forest City, 21 May 1853–4, *J. M. Bigelow* (US, GH, type of *E. grandiflorum* var. *uniflorum* S. Wats.). Placer County: Cisco, 17 June 1917, *Heller 12685* (DH, CA, US, PhA, GH, NY); 6 July 1923, *Miss Raphael* (CA); Duncan Canyon, 26 May 1926, *L. S. Smith 1867* (CA); Robertson Flat, August 1927, *W. W. Eggleston 21566* (NY). Nevada County: Donner Lake, June 1900, *W. R. Dudley* (DH). Calaveras County: Highland Creek, 3 July 1930, *M. S. Jussel* (CA). Madera County: Shuteye Mountain, 22 August 1907, *J. Murdoch Jr. 554* (US, GH, NY, CA). Tuolumne County: Wheats Meadow Trail, *W. W. Eggleston 9383* (US). Tulare County: Mt. Moses, June–July 1895, *Purpus 1341* (UC).

Type locality: "In the Sierra Nevada: near Downieville, Sierra Co. (Dr. J. M. Bigelow), and frequent in Plumas Co., whence fine specimens have been received from Mrs. M. E. Pulsifer Ames, and from Mrs. R. M. Austin." The type was collected on "hillsides near Downieville, California, May 21," by Dr. J. M. Bigelow while acting as surgeon and botanist to the

Whipple railway exploring expedition of 1863–4. From this collection also, came the type of Dr. Torrey's *E. grandiflorum* var. *multiflorum,* described by him as "stigmate clavato-capitato" which properly characterizes that organ of *E. purpurascens.*

On the same date as the last, Dr. Bigelow collected on "hills near Forest City," Sierra County, the plant referred by Torrey (Pac. R. R. Rep. 4: 145) to *E. grandiflorum* Pursh.; his description, "stigma is manifestly 3-cleft" correctly describes that organ of *E. multiscapoideum* (Kell.) Nelson & Kennedy, and the specimens of this collection in the Torrey Herbarium (New York Botanical Garden) are clearly of that species. But, on the other hand, in an examination of the Bigelow collections in the National Herbarium, Gray Herbarium, and that of the Philadelphia Academy of Sciences, I find that Dr. Torrey did not include in his distribution any material of *E. multiscapoideum* (Kell.) Nelson & Kennedy; but, instead, evidently under the impression that the specimens were of the same species, sent out one-flowered specimens of *E. purpurascens* under *E. grandiflorum* Pursh., designating a collection of very small sized plants as a variety of the same. A specimen of the larger plant in the Gray Herbarium is the type of *E. purpurascens* var. *uniflorum* S. Wats. Besides the confusion as to identity of species, it seems likely that there was a misunderstanding as to locality. "Forest City" is about ten miles south of Downieville on the divide between the middle fork and the south fork of Yuba River, in the early mining days a station on the old stage road to Nevada City. I suspect from my observations in the region, that the only species of *Erythronium* found by Bigelow in that vicinity was *E. multiscapoideum* (Kell.) Nelson & Kennedy; all the rest of his collections of the region being *E. purpurascens* from near Downieville, both the single- and multiple-flowered ones.

Dr. Alfonso Wood (Proc. Phila. Acad. 1868: 166) records having collected in 1866, in the vicinity of Downieville, an *Erythronium* which he referred to *E. grandiflorum* var. *multiflorum* Torr.

2. Erythronium klamathense Applegate, Contr. Dudley Herb. 1: 151. 1930.

Corm narrowly oblong, 3–5 cm. long, 7–10 mm. thick; leaves commonly lanceolate and very acute, frequently broader, the larger one sometimes oblanceolate and obtuse, attenuate to a narrow base, lustrous yellow-green, 7–15 cm. long, 1.5–2.5 cm. broad, rarely narrower; scape about 7–20 cm. high; flowers usually solitary but occasionally 2 or 3 to several on rather long pedicels of unequal length; perianth segments lanceolate to broadly lanceolate, acuminate, acute or the outer set acutish, 20–25 mm. long, about 5 mm. broad, the upper half or two-thirds pure milk-white, the lower part pure yellow; the auricles and basal processes always present and well developed, the

median pair, globularly inflated, the lateral ones about the same size but usually with less inflation; filaments slender, very slightly dilated below, evenly attenuate upward, about half as long as the young yellow anthers; style short and rather strongly clavate; stigma practically entire or indistinctly toothed; capsule obovoid, about 3 cm. long, 2 cm. thick.

Type in the Dudley Herbarium, no. 199386, collected among lodge-pole pines, Canadian Zone, at the south end of Four Mile Lake, near the east base of Mt. Pitt, Cascade Mountains, Klamath County, Oregon, 2 June 1926, *Applegate 4676.*

The following additional numbers were collected by myself in Oregon, and are deposited in the Dudley Herbarium of Stanford University. Jackson County: Burnt Creek, Cascade Mountains, 1 June 1895, *711;* eastern terminus of the Siskiyou Mountains, 24 May 1898, *2273;* 9 June 1925, *4359, 4360;* summit of Green Spring Mountain, 22 May 1924, *4089, 4090;* Table Mountain, 16 May 1925, *4267, 4269, 4270;* Hyatt Prairie, 16 May 1925, *4272;* 29 April 1926, *4609;* Grizzly Peak, 19 May 1926, *4641, 4642, 4647;* Dead Indian Divide, 19 May 1926, *4648;* Dead Indian road, 20 May 1926, *4652;* Grizzly Prairie, 20 May 1926, *4653;* Pilot Rock, Siskiyou Mountains, 9 June 1928, *5448;* 18 June 1928, *5541.* Klamath County: Four Mile Lake, 2 June 1926, *4669, 4674, 4680, 4682;* Badger Lake, 2 June 1926, *4683;* Long Lake, 2 June 1926, *4684, 4685;* Sky Lakes, 19 July 1929, *6078.* Douglas County: Hershberger Mountain, 11 July 1929, *5936, 6033.*

Specimens examined. Oregon. Jackson County: Abbotts Butte, 6 July 1897, *J. B. Leiberg 4230* (UO, US); Dead Indian Mountain, 6 May 1925, *A. R. Sweetser* (UO); Burnt Creek, Cascade Mountains, 1 June 1895, *Applegate 711* (GH, US); junction Siskiyou and Cascade mountains, 24 May 1898, *Applegate 2273* (GH, US, NY). Klamath County: Four Mile Lake, 20 June 1898, *Applegate 2508* (US); Mt. Pitt, 27 July 1897, *Coville & Applegate 216* (US). California. Siskiyou County: Castle Lake, 19 June 1893, *W. R. Dudley* (DH, NY); 28 July 1911, *I. J. Condit* (UC); 24 July 1921, *Alice Eastwood* (CA).

Definitely separated geographically from its nearest ally, *E. purpurascens* S. Wats., and readily distinguished from that species by the always present and well developed segment processes, a much more lax inflorescence, fewer, larger, and less delicate flowers, broader perianth segments, shorter capsule and differently colored anthers.

Flowering in its lower limits early in the season, immediately after the disappearance of the snow, and following its retreat to higher levels with the advance of the season. This species is easily grown and very responsive to cultivation. Plants grown in my garden at Klamath Falls, flowered earlier than the other endemic species of southern Oregon.

Distribution: from the vicinity of Pilot Rock, Jackson County, Oregon, the species extends eastward along the summit of the Siskiyou Mountains to their junction with the Cascade range, on the brink of the canyon of the Klamath River, in the southeast corner of Jackson County, ranging between 5000 and 6000 feet altitude, Canadian Zone, abundant on steep northerly slopes, in openings in the heavy white fir forest; thence northerly through the higher parts of the Cascade Mountains to the Sky Lakes region, Klamath County, west of Klamath Lake, where it occurs abundantly in the lodgepole pine and black hemlock forests, 6000 to 7000 feet altitude, Canadian and Hudsonian zones; appearing again north of Rogue River along the Rogue-Umpqua Divide between Abbott Butte and Hershberger Mountain, southern edge of Douglas County, in the forest of sub-alpine and Shasta fir, and on the summit of Hershberger Mountain among clumps of Alaska cedar at over 6000 feet altitude. From the Dead Indian region, it ranges westward along a spur of the Cascades to the summit of Grizzly Peak, overlooking the Rogue River Valley east of Ashland and Medford. Known only from one station in California, Castle Lake, north end of the Trinity Mountains, Siskiyou County, all of the specimens of which have heretofore been referred to what is now known as *E. grandiflorum* var. *pallidum* St. John. It is interesting to note that the first collection was made by the late Dr. W. R. Dudley, Professor of Botany, Stanford University, after whom Dudley Herbarium was named. This is the southernmost station of the species. It is separated from the northern limits of *E. californicum* Purdy by the Trinity and Scott mountains, and is in the same general region as the southern limits of two other Siskiyou Mountain species, *E. citrinum* S. Wats. and *E. Hendersonii* S. Wats. as well as that of *E. grandiflorum* var. *pallidum* St. John which occurs on the Trinity summits. About 30 miles to the southeast, across the valley of the Sacramento River, is Mt. Lassen, the northern outpost of *E. purpurascens* S. Wats., nearest of kin to the Klamath *Erythronium.* When the distributional details of the California range of the species are worked out, this range may be found to be more closely connected with that of Oregon.

In its whole range *Erythronium klamathense* Applegate rarely extends down to the 5000 foot level, and then only under favorable conditions of slope and shade; while, on the other hand, *E. Hendersonii* S. Wats. is sometimes found extending up to this level in more exposed situations. The two species are rarely found in close contact, and in only one place have I seen unmistakable examples of hybridization between them. The only other species with which it is ever associated is *E. grandiflorum* var. *pallidum* St. John. On the Umpqua-Rogue Divide these two species mingle freely and are in flower at the same time. Whether or not they hybridize, I have not as yet been able

to determine with certainty, although I am inclined to think they do.

3. Erythronium nudopetalum Applegate, Contr. Dudley Herb. 1: 189. 1933.

Corm small and slender, about 4 cm. long, 5 mm. thick; mature scapes not more than 15 cm. high; leaves commonly oblanceolate or sometimes lanceolate, rather narrow, acute, attenuate at the base without evident petiole; flowers small, the segments less than 25 mm. long, 3–4 mm. wide, narrowly lanceolate, acuminate, golden-yellow more or less streaked with green, especially on the outside, the bases of the inner ones naked; filaments slender, thin, attenuate, equaling the young anthers; anthers long, dark red or maroon; style slender, shorter than the young stamens; stigma practically entire or occasionally obscurely lobed or toothed.

Type in the Dudley Herbarium of Stanford University, collected on the north slope of the Sawtooth Mountains, Idaho, in a wet subalpine glade in a forest of lodgepole pine and subalpine fir, at the head of Bear Valley Creek, a branch of the middle fork of Salmon River, Custer County, *Applegate 6308,* 18 June, 1930. Besides the type, another collection was made on the same date under lodgepole pines in Bear Valley a few miles farther east, *Applegate 6316.*

Known only from these two collections. When the great wilderness region embraced within the upper drainage system of Salmon River is better known botanically, this species will doubtless be found to have a more extended range.

Allied to *E. grandiflorum* Pursh which it superficially strongly resembles, but differing from that species in being entirely destitute of any kind of inner segment appendages, in having an entire or obscurely lobed stigma, and leaves with less evident petioles.

Concerning the stigma difference, it was pointed out by Watson in his revision of the genus (1891), and it has been generally accepted since, that the coherence or divergence of the stigma seems to be a satisfactory basis for the separation of species into two groups, the character being fairly constant in each species. Notwithstanding this conclusion, he goes on to say that even in species with persistently coherent stigmas, it is probable that separation occasionally occurs. That this is the case, I have conclusively proved by extensive field and other investigation. On the other hand, it is also true that in the species having normally long stigma lobes, individuals are occasionally found with short lobes, or even with practically entire stigmas. In the group having entire or obscurely lobed stigmas, the style is usually correspondingly shorter and more strongly clavate; while in the other group the style is long and more slender. In the examination of many plants covering much of the range, I have found

that occasionally the stigma lobes of *E. grandiflorum* Pursh are more or less united, and rarely, almost entirely so. This is also true, but to a lesser degree, in *E. grandiflorum* var. *pallidum* St. John, especially east of the Cascade Mountains. West of that range the normal long lobed, strongly recurved stigma is more constant. In the mountains of northern Utah, in both *E. grandiflorum* Pursh and *E. grandiflorum* subsp. *chrysandrum* Applegate, the lobes are normally shorter, and not infrequently quite short and stubby to even obscurely lobed. The same thing is true of the latter in the Rocky Mountain region of Colorado and southern Wyoming, this being, apparently, the only form found there. Also in the last two regions mentioned, the style is stouter and more strongly clavate, suggesting a further approach toward the other group. In the case of *E. nudopetalum,* the stigma differentiation is carried to the point where the lobed stigma is the exception. In the other related species, *E. idahoense* St. John & Jones, the obvious difference is in the color of flower. The whole group seems to be in a plastic stage, tending toward differentiation and segregation into more or less isolated geographic units; with the white-anthered form occupying an exclusive position on the western front, the yellow-anthered one holding the same place on the eastern outpost, and the dominant red-anthered plants with the others, usually in separate colonies, widely distributed over the intermontane region.

The diagnostic importance of the presence or absence of inner-segment processes is discussed under *E. Howellii* S. Wats. another species with naked segments.

4. Erythronium tuolumnense Applegate, Contr. Dudley Herb. 1: 153. 1930.

Corm very large with copious loose membranaceous coats, about 6 cm. long, 2 cm. thick, propagating by sessile or nearly sessile offsets from the base or side, producing compact clusters or clumps; leaves not mottled, lustrous yellow-green, unusually large, from lanceolate, acute to very broadly oblanceolate with rounded apex, 2–3 dm. long, 4–8 cm. broad, gradually narrowed to a long winged petiole; scapes bright green, longer than the leaves, sometimes more or less tortuous, one to several flowered, usually approximate; segments lanceolate to oblong-lanceolate, about 30 mm. long, 8–10 mm. broad, acute or acutish, deep golden-yellow with pale greenish-yellow base gradually fading into nearly white below, the median basal processes rather well developed, the lateral ones smaller or wanting, the auricles slightly folded into a ridge; style slender, narrowly clavate and of medium length, about 10 mm. long; stigma practically entire or sometimes very shortly toothed; young anthers deep golden-yellow, about 10 mm. long, old ones about one fourth as long; filaments slender, the two sets markedly different in length, the

outer 6 mm., the inner 9 mm. long, or occasionally, the inner about twice the length of the outer; capsule obovoid, retuse.

Type in the Dudley Herbarium of Stanford University, no. 199388, collected in open yellow pine and oak woods on steep north slope of the canyon wall of the south fork of Stanislaus River, about half a mile below Italian Bar, Tuolumne County, California, altitude about 300 m., *Applegate 5549,* 26 April 1929.

The following collections were cited in the original publication of the species: in the Dudley Herbarium, *Adele Lewis Grant 633,* Five Mile Creek, and Standard City, Tuolumne County, "sent to the Annual Wild Flower Show by the Standard School, April 23, 1922"; from the University of California, *Fred Grant,* Italian Bar; *Jepson 6407,* Yankee Hill, Tuolumne County. Another collection in the same herbarium was examined recently (Keltz Mine, 7 June 1895, *W. C. Blasdale*), and referred to *E. purpurascens* S. Wats. as recorded by Dr. and Mrs. H. M. Hall in "A Yosemite Flora" (p. 57). This seems to be the earliest recorded collection of the species, the station being only a short distance above the type locality. All the other collections were referred to the wholly unlike Siskiyou Mountain endemic, *E. citrinum* S. Wats. Basin Creek, 16 Mar. 1932, *Helen Jorgensen* (CA).

Of all our western species this one stands out as the most distinct. Most remarkable is the extent to which the underground vegetative reproduction is carried on by which the corms are multiplied many times by offsets. In the moist soil, enriched by deep leaf-mold this takes place rapidly, often producing closely packed clumps of from several to half a hundred or more corms. The only other of our western species to share in this habit to any extent is another very local species, *E. helenae* Applegate, although not so commonly or to the same extent, except under the stimulus of irrigation and cultivation. Of the eastern forms, *E. mesachoreum* Knerr. seems to be the only one to reproduce in like manner, the others which grow offsets producing the corms on the ends of long, filiform runners as in our western *E. multiscapoideum* (Kell.) Nelson & Kennedy.

This remarkable and extremely local species is known only from a few isolated colonies in southwestern Tuolumne County. Although long known, and collected by a number of botanists, curiously enough it was not recognized as something entirely new.

Comparatively few of the flowers mature seed pods, the plant expending much of its energy in the vegetative reproduction already referred to.

The shrinkage of the anthers in dehiscence is unusually great, being about three fourths, while in all other species with which I am acquainted, it is approximately one half; and the difference in length of the filaments in the two sets is greater than normal, the inner being sometimes nearly twice that of the outer.

5. Erythronium grandiflorum Pursh, Fl. Am. Sept. 1: 231. 1814. *Erythronium giganteum* Lindl. Bot. Reg. sub. pl. 1786. 1835. *Erythronium grandiflorum* var. *giganteum* Hook. Fl. Bor. Am. 2: 182. 1840. *Erythronium grandiflorum* var. *albiflorum* Hook. Fl. Bor. Am. 2: 182. 1840. *Erythronium grandiflorum* var. *minus* Hook. Fl. Bor. Am. 2: 182. 1840. *Erythronium Nuttallianum* Regel, Gartenfl. 20: 227, pl. 695, figs. 1, 2. 1871. Not *E. Nuttallianum* R. & S. which equals *E. americanum* Ker-Gawl. *Erythronium grandiflorum* var. *parviflorum* S. Wats. Proc. Am. Acad. 26: 129. 1891. As to citations, otherwise in part by inference. *Erythronium obtusatum* Goodding, Bot. Gaz. 33: 67. 1902. *Erythronium utahense* Rydb. Fl. Rocky Mts. 165, 1061. 1917. *Erythronium leptopetalum* Rydb. Fl. Rocky Mts. 165, 1061. 1917.

Corm long and slender; leaves 10–20 cm. long, usually oblong-elliptic, acute to acutish, sometimes more or less oblanceolate and obtuse, all attenuate to a narrowly winged petiole; scape 15–30 cm. or higher; flowers one to several, the segments lanceolate, acuminate acute or sometimes blunt, 20–35 mm. long, 4–7 mm. broad, golden-yellow, the base lighter within and streaked with green without, the basal appendages well developed, commonly nearly equal, globular but not often very strongly inflated, definitely auricled; filaments usually only slightly wider below; anthers dark red or maroon; style long and slender, slightly enlarged upward or sometimes stouter; stigma usually with long, strongly recurved lobes or occasionally shorter to rarely nearly entire lobes; capsule obovoid, more or less retuse, about 30 mm. long, 10 mm. thick.

This was the second of our western species of *Erythronium* to be found, and like the first, is of added interest because of its historical setting. The original specimens were collected in the Clearwater region within the present state of Idaho by Meriweather Lewis. This was on the return trip of the memorable Lewis & Clark expedition of exploration to the Pacific coast. Two collections were made by Lewis, the first "From the plains of the Columbia near Kooskooskie River, May 8, 1806." This was south of the river and nearly opposite the south fork. On this day the expedition ascended the high precipitous wall of the canyon of the Kooskoosky or Clearwater River, to the high tableland, traveling only about 6 miles to a point about the same distance north of the present town of Craigmont in Lewis County, a region of grassy plains and scattered yellow pines. Lewis referred to this plateau region as "the plains of the Columbia." The second collection was made at "Camp Chopunnish" on the Kooskoosky River, June 5, 1806, which has been generally considered to be the type locality. Pursh in his original publication, says: "On the Kooskoosky. *M. Lewis* . . . May, June, *v. s.*" From the dates it might be inferred that he considered both collections. This camp opposite the present town of Kamiah,

Lewis County. The expedition spent nearly a month here waiting for the snow to melt sufficiently for a passage over the Bitterroot Mountains.

During the month of May, 1931, I explored this region for the purpose of clearing up the uncertainty as to the color of the anthers of the plant collected by Lewis. As he recorded in his journal, the Erythroniums were in "full blume" and in great abundance "on the plains of the Columbia," and although I examined many specimens along the trail of the expedition across the plains and all the way to Kamiah, I found none with white anthers, and rarely a sporadic individual with yellow anthers; so that it seems reasonable to conclude that both of Lewis's collections had red anthers, the form now generally accepted as typical *E. grandiflorum* Pursh.

The plants of the Lewis & Clark expedition were delivered by Lewis in person to Thomas Jefferson, President of the United States, who cared for them for a time and then turned the collection over to the American Philosophical Society at Philadelphia, which in turn finally deposited it with the Philadelphia Academy of Natural Sciences, founded in 1812. Here the collection was lost for about 75 years. When the specimens were recovered from an old closet, much damage had been done by insects.

The following published illustrations are of interest in a discussion of this species. In Lindley's Botanical Register, plate 1786, 1836, is a fine cut showing a plant with golden-yellow flowers with red anthers and plain vivid green leaves, without doubt the plant so abundant in the vicinity of Kamiah, Idaho, and the region thereabouts. In the text accompanying the plate, Lindley states: "Of this extremely rare plant, a single bulb was received by the Horticultural Society from North West America eight or nine years ago; it has continued to grow slowly in a peat border, and at last put forth its beautiful flowers last May. . . . Mr. Douglas, who discovered it, considered it the *Erythronium grandiflorum* of Pursh; and we adopt his opinion. . . ." Reference to Douglas' journals would indicate that the bulb referred to by Lindley was collected near Ft. Colville, Kettle Falls, Columbia River, Washington, in 1827. *E. Nuttallianum* Regel is another colored cut showing the same plant, and was cited by Watson in his original publication of *E. grandiflorum* var. *parviflorum;* which citation is discussed under *E. grandiflorum* var. *pallidum* St. John.

Distribution: Hudsonian, Canadian and Transition zones. From the Rocky Mountain region of Idaho, Montana, northern Wyoming and the Wasatch Mountains of Utah, westward through the mountains and adjacent foothills of northern Oregon and of Washington, to the eastern slope of the Cascade Mountains; with an altitudinal range of from about 400 feet along the Columbia River in eastern Hood River and western Wasco counties, Ore-

gon, and eastern Klickatat County, Washington, to above 9000 feet on the slopes of Mt. Washburn, Yellowstone National Park, Wyoming. The center of greatest abundance is perhaps in the yellow pine belt in the western foothills of northern Idaho where the species is found in extensive colonies and in great abundance in open woods, cutover lands, prairies and cultivated fields. When occupying the same region with other forms of the species, they are usually found in separate colonies, although occasional contacts are made. Rarely individuals of all three forms (red-, white- and yellow-anthered) are found growing in the same colony. In some cases hybrids were observed.

The following collections were made by myself. Oregon. Hood River County: Columbia River near Hood River, 6 May 1931, *6795, 6794.* Wasco County: Mosier, 6 May 1931, *6796.* Baker County: Blue Mountains above Sumpter, 14 June 1930, *6242, 6250.* Washington. Chelan County: Blewett Pass, Wenatchee Mountains, 24 April 1931, *6685.* Idaho. Fremont County: Snake River, near Henry Lake, 22 June 1930, *6358;* Targhee Pass, Continental Divide, 22 June 1930, *6362.* Bonner County: Hope, Pend Oreille Lake, 27 April 1931, *6703.* Kootenai County: Rathdrum, 26 April, 1931, *6702;* Coeur d' Alene, 28 April, 1931, *6709;* 5 miles southeast of Coeur d' Alene, *6710;* between Ford and Worley, 28 April 1931, *6712.* Nez Perces County: Near Culdesac, 1 May 1931, *6718.* Lewis County: between Culdesac and Winchester, 1 May 1931, *6721;* Winchester, 3 May 1931, *6760a;* Wilson Canyon near Kamiah, 3 May 1931, *6755;* between Nez Perces and Craigmont, 3 May 1931, *6758.* Idaho County: Clearwater River near Kamiah, 2 May 1931, *6729;* Lowell, middle fork of Clearwater River, 2 May 1931, *6738.* Wyoming. Yellowstone National Park: Targhee Pass, Continental Divide, 22 June 1930, *6363;* Continental Divide west of Yellowstone Lake, 23 June 1930, *6370;* Yellowstone Lake, 23 June 1930, *6371;* Mt. Washburn, 23 June 1930, *6373.* Utah. Salt Lake County: Mt. Olympus, 10 June 1934, *8402, 8408.*

Specimens examined. Oregon. Hood River County: near Hood River, 1 April 1923, *M. W. Gorman 6008* (DH, PhA), 12 March 1884, *L. F. Henderson* (UO, OS), 10 April 1924, *Kirk Whited 1069* (NY, PhA, GH). Wasco County: Mosier, 9 April 1893, *Thos. Howell* (UC, UO, UWy, DH). Baker County: above Sumpter, 6 July 1919, *Ferris & Duthie 875* (DH, UWy); Powder River Mountains, 1874, *Rev. Nevius* (GH). Wallowa County: near Bear Creek, 5 June 1907, *F. V. Coville 2383* (US). Washington. Whitman County: Pullman, 6 May 1893, *F. L. Moore* (WS), 25 April 1894, *Piper 1676* (PhA, GH, US, DH, WS, NY), Union Creek, 6 April 1922, *C. S. Parke* (WS). Spokane County: Hangman Creek, 24 May 1893, *Sandberg & Leiberg* (WS, UO, GH, US, NY). Stephens County: near Ft. Colville, 1861, *Lyall* (GH). County unknown, probably in 1833, "Columbia Plains," *Wyeth* (GH). Walla Walla County: Waitsburg, 17 April 1897,

R. M. Horner B483 (GH, US). Yakima County: Simcoe Mts., June 1879, *J. Howell* (GH); Yakima region, 1882, *T. S. Brandegee 191* (PhA). Chelan County: Blewett Pass, 18 April 1931, *J. W. Thompson 5998* (GH, US); Chiwaukam Creek, 19 May 1928, *St. John & Eggleston 21940* (US). Klickitat County: western part, April–May 1881, *W. N. Suksdorf 146* (US, PhA). IDAHO. Bonner County: Warren Island, Lake Pend Oreille, 5 April 1904, *M. B. Dunkle 349* (UI); Lake Pend Oreille, May 1891, *J. B. Leiberg* (UO); Hope, 1 April 1914, *Dunkle 338* (UI, UWy). Latah County: Moscow, 1917, *F. W. Gail* (UI), 6 April 1900, *L. R. Abrams 539* (DH, UC, NY), 1894, *L. F. Henderson* (US); Potlatch, *G. W. Goodwin* (UI). Fremont County: near St. Anthony, 20 June 1919, *E. H. Quagh 89* (DH, UWy, NY); near Henry Lake, 21 June 1899, *Nelson & Nelson 5480* (DH, UC, UWy, GH, US, NY). Custer County: Challis National Forest, 25 May 1928, *L. B Koch* (UU). Lemhi County: Salmon, 1 July 1920, *E. B. & L. B. Payson 1862* (UWy, GH, NY), 10 June 1896, *J. S. Kemp* (NY). Nez Perces County: near Lake Waha, 20 May 1892, *Sandberg, MacDougal & Heller 202* (GH, PhA, US, NY); Clear Water, *Rev. Spaulding* (about 1840) (GH); between Culdesac and Craigmont, 17 April 1933, *M. S. Baker 7400.* Boise County: Dry Buck, 10 May 1911, *J. F. Macbride 848* (US, NY, GH); near Boise City, June 1881, *T. E. Wilcox* (GH); near Boise, June 1892, *Ishabel Mulford,* type of *E. leptopetalum* Rydb. (NY). Shoshone County: between St. Joe and Clearwater River, 11 July 1895, *J. B. Leiberg 1257* (US). Owyhee County: Hotsprings, 2 July 1895, *L. F. Henderson 3101* (US). Kootenai County: Coeur d' Alene, May 1912, *H. J. Rust 3* (US), June 1890, *J. B. Leiberg* (NY). MONTANA. Gallatin County: Mystic Lake, 25 July 1895, *C. L. Shear* (US, NY); Bridger Peak, 25 May 1900, *V. K. Chesnut and W. W. Jones 198a* (US), 18 June 1897, *Rydberg & Bessey* (UM, UWy, MS, GH, US, NY); near Bozeman, *J. W. Blankenship* (UM); Gallatin Forest, 21 May 1922, *W. A. Chippenfield* (UM); Middle Creek Canyon, 26 July 1897, *D. B. Swingle* (UWy); Bozeman Pass, 2 June 1883, *W. M. Canby 323* (GH, PhA, US), 28 May 1883, *F. L. Scribner 283* (GH, PhA); Bozeman, 1907, *Hattie M. Hodgman* (GH); Bald Mountain, 22 July 1880, *S. Watson 417* (GH, US); Limekiln Canyon, 1 June 1905, *Blankenship 475* (PhA). Powell County: Deer Lodge, *Mrs. L. A. Fitch* (UM), May 1888, *F. M. Traphagen* (NY). Madison County: Sheridan, July 1896, *H. M. Fitch,* (UM, DH, NY); Madison Valley, May 1814, *Glen Conkling* (UM), 8 July 1871, *G. N. Allen* (US); Spanish Basin, 18 July 1896, *J. H. Flodman 347* (US, NY), 1 July 1897, *Rydberg & Bessey 3872* (US, NY). Deer Lodge County: *Miss F. I. Hobson* (MS), 5 June 1891, *Professor Merritt* (NY). Park County: Livingston, 1898, *Mrs. Scheuber* (MS), 18 May 1901 *E. W. Scheuber* (US, NY). Missoula County: near Missoula, 12 June 1901, *D. T. MacDougal 158* (US, NY). Judith Basin County: Belt Mts., 28 June 1885, *F. W.*

Anderson 8162 (NY). Lewis & Clark County: Helena, 1 June 1892, *F. D. Kelsey* (NY). Wyoming. Yellowstone National Park: Buffalo River, 16 June 1930, *Mrs. Van Dyke* (CA); Lake Camp, 19 June 1924, *H. S. Conard 1038* (UWy); Glen Creek, 1 July 1899, *Nelson & Nelson 5606,* type of *E. obtusatum* Goodding (UWy); near Obsidian Cliffs, 20 July 1911, *R. H. Smith* (PhA); Mt. Washburn, 13 July 1902, *E. A. Mearns 1842* (US); Electric Peak, 26 July 1902, *E. A. Mearns 169* (US); 18 August 1893, *J. N. Rose 227* (US); near Mammoth Hot Springs, July 1893, *F. H. Burglehaus* (US); Specimen Ridge, 23 August 1887, *F. H. Knowlton* (US); Swan Lake, June 1885, *Frank Tweedy 505* (US); Corke Lake, 15 July 1888, *F. H. Knowlton* (US). Teton County: Whetstone Creek, 26 June 1929, *O. J. Munie 129* (UWy). Utah. Salt Lake County: Brighton, *V. C. Fish* (UU); Dry Creek Canyon, *J. Goldstein* (UU); Park City, 29 June 1893, *Mrs. Snyder* (UC); Peterson Canyon, 19 July 1902, *Pammel & Blackwood 3860* (GH); base of Wasatch Mountains, 22 April 1904, *A. O. Garrett* (GH); Big Cottonwood Canyon, 13 May 1909, *Mrs. Joe Clemens* (GH, DH); Dry Canyon, 10 June 1908, *Mrs. Clemens* (GH, PhA); Salt Lake City, May 1869, *S. Watson* (GH, US), *A. O. Garrett 997* (US); City Creek Canyon, 20 April 1900, *S. G. Stokes* (US, NY, DH, UC); Wasatch Mts., April 1871, *Nevius* (US); Parleys Peak, July 1869, *S. Watson* (NY); Cottonwood Canyon, July 1869, *S. Watson* (NY); Salt Lake, 1850, *Captain Stansbury,* type of *E. utahense* Rydb. (NY); City Creek Canyon, 11 May 1880, *M. E. Jones* (NY); Big Cottonwood Canyon, 29 June 1905, *Rydberg and Carlton 6506* (NY), 8 June 1920, *A. O. Garrett 2907* (NY); Ft. Douglas, 28 May 1911, *M. E. Jones* (DH, UC); City Creek Canyon, 3 April 1883, *F. E. Leonard* (DH, UC). Rich County: Bear River Canyon, August 1869, *S. Watson 1175* (GH, US); near Bear Lake, 18 June 1932, *Rua Pierson 642* (NY). Weber County: near Ogden, June 1872, *J. M. Coulter* (US). Box Elder County: Bingham, 23 April 1890, *M. E. Jones* (NY). Cache County: 2 May 1909, *C. P. Smith* (DH).

In the publication of his *E. obtusatum,* Goodding cites two collections: Yellowstone National Park, Glen Creek, 1889, *Nelson & Nelson 5606* (type), and Idaho, Continental Divide near Henry Lake, 1899, *Nelson & Nelson 5480* (cotype). Having made collections of many specimens in both localities cited, and carefully examined the type material in the Rocky Mountain Herbarium of the University of Wyoming, together with duplicates and other material in various other herbaria, I can find nothing to distinguish it from *E. grandiflorum.* Goodding's use of filament width is of no value in this connection. In all the forms of *E. grandiflorum* Pursh, there is more or less variation in width of this organ over a very wide range, but it is too indefinite and inconstant to be of diagnostic use.

Rydberg in describing his two species, *E. utahense* and *E. leptopetalum,* uses anther-length as a determining character, which is valueless when we consider behavior in the various stages of anther development, a discussion of which will be found under *E. idahoense* St. John & Jones. The two species described by Rydberg are separated upon the basis of style thickness and segment width, which in the present instance can not be relied upon. In the various forms of *E. grandiflorum* there is considerable variation in the thickness and shape of the style and the length of the stigma lobes. This is more pronounced in the Wasatch Mountains of Utah, and in the Rocky Mountain region of Colorado and southern Wyoming, the stouter and more clavate style and shorter stigma lobes predominating in contrast to the more slender style and longer, more strongly recurved stigma lobes dominant in the intermontane regions, and especially west of the Cascade Mountains. The width of the perianth segment is also variable and not to be relied upon. For example, at Cle Elum, Washington, I found many plants of *E. grandiflorum* var. *pallidum* St. John (*Applegate 6680*) with very narrow segments, even narrower than in the type of *E. leptopetalum* Rydb. The same thing is true of *E. grandiflorum* Pursh around Rathdrum, Idaho (*Applegate 6702*). The type collection of *E. leptopetalum* Rydb. was made by Ishabel Mulford near Boise, Idaho, and is deposited in the herbarium of the New York Botanical Garden. This I have examined and found to be what I should say is good *E. grandiflorum* Pursh. While collecting in the type region, I found only that species. The type of *E. utahense* Rydb. is in the same herbarium, and was collected in the spring of 1850 at Salt Lake, Utah, by Captain Stansbury while making a government survey of Salt Lake. Recently I examined the type and many other collections determined by Rydberg as belonging to his species, and made collections and other investigations in the region, from all of which I conclude that *E. grandiflorum* Pursh is the only species in the vicinity of Salt Lake.

E. grandiflorum var. *minus* was evidently applied to small, single-flowered specimens of the type. For many years this name has been used indiscriminately for the various forms of the species, especially for the higher mountain plants, much in the same way as Watson's name *E. parviflorum.* Watson (l.c. 1891) says that this is the same as the name used by Morren and others (*E. grandiflorum* var. *minus* Morren Belg. Hort. 26: 109, t. 6. 1886).

5a. Erythronium grandiflorum var. pallidum St. John. Research Stud. St. Col. Wash. 2: 113. 1931. *Erythronium grandiflorum* Pursh var. *parviflorum* S. Wats. Proc. Am. Acad. 26: 129. 1891, in part by inference, but not as to type. *Erythronium*

parviflorum Goodding, Bot. Gaz. 33: 67. 1902, in part as to nomenclature, but not as to type.

Differs from the type in having white anthers instead of red ones, unequal filament lengths in each set, and stigma lobes which perhaps average slightly longer.

In *E. grandiflorum* Pursh and all other species of the genus with which I am familiar, the filaments in each set are normally of equal length, those of the outer set being the shorter. In the examination of a great number of plants over practically the entire range of this widely distributed white-anthered form, I have found this irregularity to be fairly constant. Rarely they are regular, and occasionally the filaments are all of the same length.

Type: "Washington, rock-slide near snow-bank, Horseshoe Basin, Chelan County, July 13, 1923, *H. St. John and L. Ridout 3670* (type in Herb. State College of Washington)."

Zonal distribution: eastward from the Cascade Mountains, Hudsonian, Canadian and Transition, the same as that of the typical form; westward from the Cascade Mountains, Hudsonian and Canadian.

Geographical distribution: the coast ranges and Klamath Mountains of northwestern California, the Siskiyou and coast ranges of Oregon, the Olympic Mountains of Washington, the higher parts of the mountains of Vancouver Island, all of the mountains of the mainland of southern British Columbia and southwestern Alberta, throughout the Cascade Mountains of Oregon and Washington, eastward through the Blue and Wallowa mountains of northern Oregon, the hills and mountains of eastern Washington to the Rocky Mountain region of Idaho and Montana. It seems rather remarkable that this form should occur in the region west of the Cascade Mountains to the entire exclusion of the typical form, and that it should be there restricted to the higher parts of the mountains. It is also interesting to note that in the Rocky Mountains of Wyoming and Colorado and the mountains of northern Utah, it is replaced by the yellow-anthered form, *E. grandiflorum* subsp. *chrysandrum* Applegate, which also has a high altitudinal range.

Specimens collected. Oregon. Wallowa County: Paradise, 3 July 1930, *6485*. Union County: near Wallowa River, 4 July 1930, *6502*. Umatilla County: Meacham, Blue Mts., 5 July 1930, *6512*. Hood River County: Mt. Hood, 14 August 1932, *8258, 8273*. Douglas County: Hershberger Mt., Cascade Mountains, 11 July 1929, *5937;* Rabbit Ears, Cascade Mountains, 13 July 1929, *6018*. Josephine County: Mt. Grayback, Siskiyou Mountains, 13 June 1927, *5062, 5063;* 16 June 1927, *5081, 5086;* 17 July, 1933, *8766*. Klamath County: near Government Camp, Crater Lake National Park, 22 August 1933, *8826*. Washington. Asotin County: near Anatone, 30 June 1930, *6457*. Kittitas County: Cle Elum, 24 April 1931, *6680;* Blewett Pass, Wenat-

chee Mountains, 24 April 1931, *6683*. Chelan County: Blewett Pass, 24 April 1931, *6684, 6685a*. Klickatat County: Warwick, 6 May 1931, *6792*. MONTANA. Granite County: Georgetown Lake, 26 June 1931, *6411;* Skalkaho road, continental divide 27 June 1931, *6423*. IDAHO. Bonner County: Athol, 28 April 1931, *6706*. Kootenai County: Rathdrum Prairie, 28 April 1931, *6707;* Coeur d'Alene, 28 April 1931, *6708*. Valley County: Payette River watershed, Sawtooth Mountains, 18 June 1930, *6304, 6307*.

Specimens examined. OREGON. Wasco County: Mosier, 7 April 1928, *J. W. Thompson 4053* (DH, GH, PhA, US); Cascade Mountains, 18 April 1903, *J. Lunell 27* (GH). Hood River County: Mt. Hood, 6 August 1927, *J. W. Thompson 3503* (DH, PhA); Elk Cove, Mt. Hood, 17 August 1927, *Carl English Jr. 858* (WS); Mt. Hood, 17 August 1917, *Mrs. M. P. Russell* (GH), Sept. 1882, *Mrs. P. G. Barrett 37* (GH), 21 June 1924, *L. F. Henderson 804* (GH); near Hood River, 7 April 1928, *J. W. Thompson 4048* (PhA, US, GH, DH). Lane County: Bohemia Mountain, 2 May 1926, *J. R. Patterson* (UO); Cascade Mountains, 6 June 1928, *V. F. Macduff* (PhA). Curry County: Game Lake, 30 June 1929, *Mrs. Leach 2400* (UO). Benton County: west of Corvallis, 28 June 1920, *A. N. Stewart* (UM); Mary's Peak, 27 April 1918, *W. E. Lawrence 1431* (DH), 10 May 1914, *H. C. Gilbert* (OS, UC), 15 May 1921, *M. E. Peck 10842* (PhA). Jackson County: Mt. Ashland, 29 June 1929, *Kildale & Gillespie 8055* (DH). Josephine County: Oregon Caves, 28 May 1928, *Mrs. Leach* (UO); Mt. Grayback, 15 June 1904, *C. V. Piper 6232* (CA, GH); Red Mountain, Siskiyou Mountains, 14 June 1898, *J. B. Leiberg 4069* (UO, US). Klamath County: Vidae Ridge, Crater Lake National Park, 27 June 1928, *Lyle Wynd 2066* (UO). Grant County: Canyon City, 26 May 1927, *L. F. Henderson 8834* (UO). Wheeler County: Canyon Creek, *L. F. Henderson 5120,* 4 May 1925 (UO, GH). Umatilla County: near Meacham, 10 May 1928, *Mrs. N. P. Gale 253* (GH, PhA, US). Union County: 1881, *W. C. Cusick 70* (GH). Gilliam County: near Condon, 10 May 1928, *Mrs. N. P. Gale 258b* (PhA). Douglas County: Abbott's Butte, 29 June 1898, *Applegate 2601* (US). WASHINGTON. Jefferson County: Olympic Mountains, June 1914, *A. D. E. Elmer* (UO), 23 July 1929, *Maj. Nation* (PM). Okanogan County: Sheep Mountain, 1 August 1916, *W. W. Eggleston 13287* (US). Pierce County: Mt. Rainier, July 1922, *L. R. Abrams 9156* (DH), July 1896, *J. B. Fleet* (UC), 1899 (US), August 1895, *C. V. Piper 2100* (GH, US), *Lyman Benson 2305* (NY); Goat Mountains, 23 July 1894, *O. D. Allen 82* (DH, UC, WS, GH, US, NY). Kittitas County: Cle Elum, 4 May 1929, *Lyman Benson* (DH); near Ellensburg, 24 April 1897, *K. Whited* (WS); Klickatat hills, April 1895, *Howell* (UO); near Lauderdale, 18 April 1931, *J. W. Thompson 6028* (GH, US); Teanaway Creek, 26 July 1928, *K. Whited 765* (GH); Swauk River, 1913,

S. P. Sharples 35 (GH, NY); Wenatchee Mountains, 20 June 1903, *J. S Cotton 1206* (PhA, US); Cle Elum, 1897, *Kirk Whited* (US). Clallam County: Olympic Mountains, June 1900, *A. D. E. Elmer 2491* (DH, WS, UO, US, NY). Asotin County: near Anatone, 30 May 1928, *St. John & Palmer 9593* (WS). Skamania County: Mt. Adams, 9 August 1894, *F. E. Lloyd* (NY). Chelan County: Horseshoe Basin, 13 July 1923, *St. John & Ridout 3670,* type (WS); Beverly Creek, near Mt. Stewart, 16 May 1931, *J. W. Thompson 6393* (GH); Dirtyface Mt., 24 June 1932, *J. W. Thompson 8554* (NY). Snohomish County: Silverton, 1899, *Mrs. Bouch* (WS); Mt. Dickerman, 17 July 1932, *J. W. Thompson 8829* (NY). Yakima County: above Chinook Pass, 25 June 1926, *F. I. Pickett 1361* (WS). Klickatat County: Appleton, 5 May 1911, *R. K. Beatty* (WS). Pend Oreille County: Dolkena, 11 May 1923, *C. H. Spiegelberg 83* (WS). Garfield County: near Pomeroy, 2 May 1921, *W. D. Courtney* (WS). Columbia County: Stayawhile Springs, 6 August 1927, *H. St. John & C. P. Smith* (WS). Walla Walla County: July 1896, *C. V. Piper* (WS, UO). Idaho. Bonner County: Priest River, 4 June 1925, *J. C. Witham* (WS). Idaho County: Lolo Trail, 17 July 1902, *C. V. Piper* (WS). Montana. Glacier National Park: Morning Eagle Falls, 11 August 1919, *P. G. Standley 17563* (US, GH); Glacier Basin, 5 August 1901, *F. K. Vreeland 1040* (GH, US, NY); near Iceberg Lake, 11 July 1919, *Standley 15451* (US, NY); 11 July 1914, *A. S. Hitchcock 11954* (US); 31 July 1917, *W. B. Dunkle* (UI). Lake County: Swan Lake, *M. J. Elrod* (UM); Flathead Lake, July 1908, *M. E. Jones* (UM). Glacier County: Kootenai Mountains, 11 August 1901, *L. M. Umbach* (PhA, US, NY); Midvale, 16 June 1903, *L. M. Umbach 48* (US, NY); near St. Mary's Lake, 24 June 1901, *Stuart Weller* (US); Flathead Pass, 29 June 1905, *J. W. Blankinship 475* (US). Missoula County: Missoula, 7 June 1897, *M. J. Elrod* (MS, UM), May 1907, *J. A. Hughes* (UM). Deer Lodge County: Anaconda, 5 June 1891, *S. A. Merritt* (UM), 1 June 1892, *F. D. Kelsey* (UC). Flathead County: near Granite Park Chalets, July 1919, *Standley 16246* (US); near Glacier Park Station, 6 July 1919, *Standley 15139* (US); near Columbia Falls, 24 July 1892, *R. S. Williams 135* (US); Glacier Park Station, 1920, *Mrs. O. Thompson* (US); MacDougal Peak, August 1901, *D. T. MacDougal 626* (US, NY), 31 July 1908, *B. T. Butler 978* (NY); Columbia Falls, 5 May 1893, *R. S. Williams* (NY, MS). California. Siskiyou County: Marble Mountain, June 1901, *H. P. Chandler 1619* (DH, UC, US, NY); Siskiyou Mountains, June 1879, *V. Rattan* (DH); Marble Mountain, 9 July 1910, *Butler 1715* (UC). Trinity County: Union Creek, July 1909, *H. M. Hall 8647* (UC); Trinity Summit, 1 July 1901, *Mrs. Manning 6* (US, UC). Humboldt County: South Fork Mountain, 9 June 1896, *Blasdale* (UC). British Columbia. Mt. Provost, Vancouver Island, 16 May 1910, *H. J. Muskeet* (PM); Mt. Ben-

son, Vancouver Island, 6 August 1887, *John Macoun* 7 (GH), 8 June 1887 (NY); Cranbrook, 17 June 1915, *Garrett* (PM); Lytton Mountains, 14 July 1924, *W. B. Anderson* (PM); Creston, 2 May 1908, *J. R. Anderson* (WS); Chase, 29 April 1918, *J. R. Anderson* (WS); Crawford Bay, *Harrison* (WS); Enderley, 28 June 1907, *J. R. Anderson* (WS); near Glacier, 5 July 1896, *W. R. Dudley* (DH); Emerald Lake, 20 June 1904, *R. T. Shaw* (UWy, GH, PhA); Big Bend district, July 1931, *C. H. Shaw 1061* (GH, PhA, US, NY); near Glacier House, June 1896, *Clara E. Cummings* (GH); Asulkan Valley, 14 August 1904, *J. G. Jack* (GH); Rogers Pass, August 1890, *J. M. Macoun* (GH); Yoho Trail, 2 August 1903, *M. A. Barber 303* (GH); Asulkan Valley, 21 June 1906, *S. Brown 248* (GH, PhA, US, NY); near Field, 29 June 1906, *S. Brown 362* (GH, PhA, US); Illecillewaet River, 27 August 1904, *H. Peterson 570* (GH, PhA, US, NY); Selkirk Range, 20 August 1885, *John Macoun* (GH); Kootanie Lake, 10 July 1890, *John Macoun* (GH, US); Kicking Horse Lake, 22 July 1885, *John Macoun 5963* (GH); Cascade Summit, Glacier, August 1895, 1901, *Dr. C. Schaffer* (PhA); Selkirk Mountains, 31 July 1890, *John Macoun* (US, NY); Moose River, 20 July 1911, *N. Hollister 53a* (US); Great Northern Mountain, 3 August 1904, *E. W. Scheuber* (US); Burgess Pass, 1919, *Mary Walcott* (US); Chilliwack Valley, 14 July 1901, *John Macoun* (US, NY); Glacier, July 1897, *Zoe Palmer* (NY); between Kettle and Columbia Rivers, 26 May 1902, *J. M. Macoun* (NY); Chilliwack Valley, 14 June 1906, *W. Spreadbrough* (NY); Revelstoke, 14 May 1902, (NY); Tulamee River, July 1900, *J. F. Kemp* (NY). Alberta. Mt. Massey, Fortress Pass, 7 July 1927, *A. J. Ostheimer 3rd. 72* (GH); near Beaver River, June 1928, *A. H. Brinkman 3004* (NY).

In the publication of the new name, Dr. St. John has set forth fully and convincingly his reasons for discarding the name *parviflorum.*

Following is a copy of Watson's original publication of his variety *parviflorum;* "Scape usually low; flowers smaller, the segments 12 to 15 lines long.—*E. Nuttallianum,* Regel, Gartenfl. t. 695, not R. & S.; *E. grandiflorum,* Murray, Gard. Chron. 1874, fig. 173. In the mountains from Colorado and northern Utah to British America, in the Blue Mountains of Oregon, and in the Cascade Mountains of Washington and British Columbia; the more common form."

It will be noted that in the brief description there is no reference to anther-color, size of plant and flower alone being considered. A complete field survey of the whole range of the widely distributed *E. grandiflorum* complex furnishes convincing proof that there is no ground for separation on this basis. In an examination of all of the material in the Gray Herbarium where Watson worked, and where all of his *Erythronium* types are held, I found no evidence to indicate that he had any particu-

lar collection which might reasonably be considered the type; and his inclusion of the whole range of the three forms of the species in that of his variety only lends weight to the conclusion that anther-color had nothing to do with the question under consideration.

As to the two citations quoted above: the first, according to St. John, is a good colored plate showing a plant with red anthers, which "is clearly identical with the earlier *E. grandiflorum* Pursh, and hence different from the white-anthered plant so long called var. *parviflorum*." The second cut "is not colored, and the accompanying discussion makes no mention of the color of the anthers, but, in absence of proof, there is no reason to assume that it is different from *E. Nuttallianum* Regel or *E. grandiflorum* Pursh. The plant came from near Salt Lake, Utah." During the season of 1933, I collected *Erythronium* in the region about Salt Lake. From these field investigations, information furnished me by the botanists of the region, and examinations of many collections in various herbaria, including that of the University of Utah, in Salt Lake City, I am convinced that *E. grandiflorum* Pursh is the only form of *Erythronium* to be found in the vicinity of Salt Lake. The only other occurring within the borders of the state of Utah, seems to be the yellow-anthered form, *Erythronium grandiflorum* subsp. *chrysandrum* Applegate. This I found in abundance on Mt. Timpanogos near Provo.

Further discussion of the *Erythronium grandiflorum* group will be found under *E. grandiflorum* subsp. *chrysandrum* Applegate, which explains the unique nomenclatorial position of the name *parviflorum* as used in the specific category by Goodding.

5b. Erythronium grandiflorum subsp. chrysandrum Applegate, Contr. Dudley Herb. 1: 190. 1933. *Erythronium parviflorum* Goodding, Bot. Gaz. 33: 67. 1902, as to description and type. Not *E. grandiflorum* var. *parviflorum* S. Wats. which equals *E. grandiflorum* Pursh.

Anthers golden-yellow; otherwise the same as the typical red-anthered *E. grandiflorum* Pursh.

In the Wasatch Mountains of Utah and in the Rocky Mountains of Colorado and of southern Wyoming, the style is rather commonly stout and strongly clavate, and the stigma lobes often quite short and erect or spreading instead of recurved, and rarely with a very shortly lobed to merely a toothed stigma. This is also true of *E. grandiflorum* Pursh in the mountains of northern Utah where Watson collected it in 1869. His description (Bot. King Exp. 348. 1871) reads: "stigma capitate or more or less 3-cleft and spreading. . . ."

Type in the Dudley Herbarium, 207818, collected in a field cleared from yellow pine woods, in the vicinity of Winchester, Nez Perces County, Idaho, 3 May 1931, *Applegate 6760*.

Other collections were made in Idaho the same year by myself as follows: near Athol, Bonner County, *6706a,* and five miles east of Rathdrum, Kootenai County, *6707a,* 28 April; near Culdesac, Nez Perces County, *6721a,* 1 May; near and west of Kamiah in Lewis County, *6755a* and between Craigmont and Nez Perces, Lewis County, *6758a,* 3 May. In 1933, I collected the following in Utah: west slope of Mt. Timpanogos, near Provo, Utah County, *8427* and *8428,* 12 June, and north slope, *8446,* 13 June.

Specimens examined. Wyoming. Albany County: Telephone Mines, 30 July 1900, *A. Nelson 7833* (UWy, UC, OS, DH, UO, UCo, NY, GH, US, UWy, the last the type of *E. parviflorum* Goodding); University Camp, Medicine Bow Mountains, 29 June 1925, *A. Nelson 10558* (UWy, UC); Medicine Bow Mountains, May–August 1929, *Nelson 11038* (UWy, UC, NY) and August 1909, *Nelson 9238* (UW, DH, US, GH, NY); La Plata Mines, 22 August 1895, *Nelson 1796* (US, GH, NY); Medicine Bow Mountains, June 1902, *J. F. Kemp* (NY). Johnson County: Big Horn Mountains, 1 May 1905, *Vie Willits* (UWy); Trabbing Creek, 6 May 1909, *Vie Willits* (UWy). Carbon County: Hayden Forest, 7 July 1915, *W. W. Eggleston 11294* (US); Encampment, 7 July 1911, *Merritt Cary 652* (US); Battle, Continental Divide, 20 June 1901, *Frank Tweedy 4457* (US, NY); Douglas Creek, 12 June 1896, *W. O. Owens* (UWy). Colorado. Larimer County: Estes Park, 17 June 1908, *W. S. Cooper 122* (UWy); Chambers Lake, 30 June 1921, *Caroline M. Preston* (CS); Cameron Pass, *New York Botanical Garden 2461* (UWy, CS, UM, US, WS, NY), 24 July 1894, *C. S. Crandall 480* (US), 14 July 1896, *C. F. Baker* (NY); Mt. Cameron, 6 July 1908, *G. F. Osterhout 3763* (DH); White Mountains, 9 August 1873, *J. M. Coulter* (PhA); Buffalo Pass, (UCo). Boulder County: Long's Peak, 5 August 1886, *G. W. Letterman* (US, PhA); near Long's Peak, 1868, *Vasey 555* (US, GH); Ward, 24 June 1923, *Hazel M. Schmoll* (UCo); Arapahoe Peak, 29 July 1918, *J. W. Clokey 3145* (NY). Jackson County: mountains west of North Park, 22 August 1899, *G. F. Osterhout* (NY); North Park, 7 July 1894, *C. S. Crandall* (NY); Rabbit Ears, 14 July 1903, *L. N. Goodding 1538* (UWy, UCo, DH, UC, US, PhA, GH, NY); Rabbit Ears Pass, 2 August 1917, *Johnson & Hedgcock 767* (UWy); Buffalo Creek, 29 June 1901 (UU), Buffalo Pass, 13 August 1898, *Shear & Bessey 3864* (NY). Gunnison County: near Mt. Carbon, 9 June 1910 *W. W. Eggleston 5710* (US), 6 June 1910, *Eggleston 5647* (US), 26 May 1910, *Tidestrom 3430* (US). North Park near line between Routt and Jackson counties, 22 August 1899, *G. E. Osterhout* (UWy, cotype *E. parviflorum* Goodding). Garfield County: Battlement National Forest, 30 July 1912, *J. R. Searge* (US). Montrose County: Uncompahgre Divide, 6 June 1912, *E. B. Payson 44* (UWy); Tabequache Basin, 3 June 1914, *Payson 378* (GH, DH, UWy, UCo). Mesa County: Grand Mesa,

23 June 1901, *C. F. Baker 224* (UWy, UC, US, GH, NY). La Plata County: Bear Creek Divide, La Plata Mountains, 29 June 1928, *Baker, Earle & Tracy 213* (NY, US), and 15 July (US); Durango, July, *L. M. & N. T. Schedin* (UWy); Needle Mountains, 14 July 1901, *W. Cross 47*. Delta County: source of Leroux River, 21 July 1892, *J. H. Cowen* (CS); High Mountains, 21 July 1892, *Cowen* (US). Pitkin County: Ohio Pass, Elk Mountains, 1881, *Brandegee* (UC); near line between Montezuma and La Plata counties: Crested Butte, La Plata Mountains, June 1890, *Alice Eastwood* (UCo). Utah. San Pete County: Manti Canyon, 6 July 1899 (UU), 1 June 1928, *V. C. Fish* (UU); Manti National Forest, 20 July 1908, *W. C. Clos* (US); Ephriam Canyon, 14 August 1907, *Tidestrom 228* (US). Summit County: Bear River, Uinta Mountains, 7 July 1926, *E. B. & L. B. Payson 4898* (PhA, GH, US, UWy, UC, DH). Utah County: near Provo, Wasatch Mountains, 16 June 1902, *Goodding 1131* (US, NY, DH, UC, UWy, GH); Mt. Majestic, 28 June 1905, *Rydberg & Carlton 6367* (NY, US); Provo, 10 July 1924, *M. E. Jones 5589* (US). Idaho. Nez Perces County: Winchester, 15 May 1927, *F. W. Gail* (UI).

Distribution: in Idaho, as far as I know, to be found only in two rather widely separated localities. On the high tableland south of the Clearwater River in the vicinity of Winchester, the type locality, the species occurs in a very restricted area, in abundance among a scattered growth of yellow pine, open pasture lands, and in cultivated fields. Here was found only an occasional individual plant with red anthers by which the yellow-anthered form is almost entirely replaced in the surrounding region. No white-anthered plants were found anywhere in the Clearwater region. More than one hundred miles to the northward there is an occasional sporadic occurrence of the yellow-anthered form in the timbered flat country lying between Pend Oreille and Coeur d' Alene lakes, where there is an abundant intrusion, from the east, of the white-anthered ones into a large area of red-anthered plants. At the point of contact were found also intermingled individuals with pink or purplish anthers, teratological forms and other evidence of hybridization. In Utah the yellow-anthered form seems to be confined to the Uinta Mountains and to the southerly parts of the Wasatch Mountains. In the Rocky Mountain region of Wyoming and Colorado it is the common form. Collections have been made in the La Plata Mountains in southwestern Colorado, and reported from La Plata County near where these mountains branch off from the main continental divide and continue southeasterly as the San Juan Mountains across the border into New Mexico. Although *Erythronium* has never been reported from that state, I suspect that the genus will sometime be found there among the high peaks of the San Juan range. In western Colorado *E. grandi-*

florum subsp. *chrysandrum* seems to be common on the Grand Mesa and in the Umcompahgre Mountains.

Goodding's plant, as to designated type and essentially as to description, is the same yellow-anthered form, based upon collections from "Wyoming, Telephone Mines, 1900, Aven Nelson 7833" (Type), and "Colorado, summit of mountains west of North Park, 1899, G. E. Osterhout" (cotype). In his remarks accompanying the original publication, Goodding says: "This species differs from *E. grandiflorum* principally in being much smaller, in its smaller bright yellow flowers"; adding that "the description of *E. grandiflorum parviflorum* Wats. is very indefinite and incomplete, but undoubtedly refers to the above form, which is well worthy of specific rank."

In June, 1933, at the Rocky Mountain Herbarium of the University of Wyoming, Laramie, I examined all of the type material and many other specimens from the type region, and interviewed various botanists familiar with the plant. More recently I have corresponded with other botanists, who later in the season than my visit, made special field investigations for me, having in mind, particularly, anther-color. All of which furnished convincing evidence that there is only the yellow-anthered form throughout the entire region. At the time of my visit, it was too early in the season for flowering specimens of *Erythronium.*

It is amply apparent that Goodding, intending to raise Watson's varietal name to specific rank, and having at hand the yellow-anthered form, under the mistaken belief that it was the same, calls attention to Watson's incomplete description which he undertakes to amplify. At the same time, he designates a definite type which proves to be the common yellow-anthered Rocky Mountain form. So, notwithstanding the fact that he had in mind Watson's plant, which turns out to be the typical red-anthered form, he unintentionally published a new species based upon the yellow-anthered plant. To add to the complexity of the situation, St. John, in discarding Watson's varietal name, relegated Goodding's specific use of it to the same position on the ground that it was based entirely upon Watson's variety, under the misapprehension that it applied to the same white-anthered form to which he gave the new name *E. grandiflorum* var. *pallidum,* in allusion to the color of the anthers. In this connection, it is interesting to note that at the time of publication of the names of these two segregates (var. *pallidum* and subsp. *chrysandrum*) neither author realized that the representatives of *E. grandiflorum* in the Rocky Mountains of Colorado and of southern Wyoming had yellow anthers; nor does it appear likely that Goodding, at the time he named his plant, understood that the form west of the Cascade Mountains was the white-anthered one. And so the whole story resolves itself into a complicated case of mistaken identity.

6. Erythronium idahoense St. John & Jones, Research Stud. St. Col. Wash. 1: 91. 1929. *Erythronium grandiflorum* var. *albiflorum* Purdy, Flora and Sylva 250–256. 1904. *Erythronium grandiflorum* subsp. *candidum* Piper, Fl. Southeast Wash. 61. 1914.

Corm 5–7 cm. long, about 1 cm. thick; leaves commonly oblanceolate, acute (the larger sometimes obtuse) attenuate to a long slender narrowly winged petiole, frequently pink at base, 10–15 cm. long, 1–2.5 cm. broad; scape 15–20 cm. high, usually pink below, seldom bearing more than one flower; buds greenish, the young flowers greenish-white, becoming creamy to pure white with solid greenish-yellow center, the segments lanceolate, acuminate, 3.5–4.5 cm. long (rarely longer), 10–12 mm. broad, the inner set often angled at the broadest part and abruptly narrowed at the base, the median appendages well developed, flattish, elongated, the lateral ones represented by the revolute edges of the rather small auricles; filaments filiform, of nearly uniform width, the two sets regular, the inner usually at least 2 mm. longer than the outer; anthers white, the young ones commonly about 15 mm. long; style clavate, very slender below, more or less kinked, and often somewhat declined at base; stigma moderately cleft, the lobes stoutish, not strongly recurved, sometimes slightly unequal in length; capsule about 5 cm. long, 15 mm. thick, the angled sides oblanceolate in outline, apex obtuse.

In 1931 I collected specimens in Idaho as follows: Kootenai County, near Ford, 28 April, *6711;* near Worley (type locality), 28 April, *6713;* Benewah County, Plummer, 29 April, *6714.*

While at Pullman, Washington, April, 1931, I examined all of the specimens in the herbarium of the Washington State College cited in the original publication of the species.

Type: "Cut-over pine woodland, Worley, Kootenai County, Idaho, 21 March, 1926, *St. John, English, Jones, Ransom & Ridout, 3719* (type in herb. State College of Washington." The type of Piper's subsp. *candidum* (in the U. S. National Herbarium) was collected on Steptoe Butte, Whitman County, Washington, 6 April 1906, by J. W. Hungate. Mr. Purdy writes me that his material of *E. grandiflorum* var. *albiflorum* Purdy came from Fairfield, Spokane County, Washington, which is about twenty-five miles southwest of the type locality of the species.

Distribution: in the yellow pine region along the eastern border of Washington, in Pend Oreille and Whitman counties, and the western border of Idaho, in Kootenai and Benewah counties. Extremely abundant in the southwest corner of Kootenai and the northwest corner of Benewah County (the type region), in low, rolling hills with intervening small valleys. In passing southward from Coeur d' Alene Lake, the whole country is yellow with *E. grandiflorum* Pursh to a point just south of Ford where that species abruptly ends at the edge of an east and west road. On the opposite side of the road *E. idahoense* appears as suddenly and in as great abundance, everywhere—in the woods,

in the open pastures and in wheat and alfalfa fields, extending southward without interruption for perhaps fifteen miles to the edge of the treeless plains in the vicinity of Tekoa in the northeast corner of Whitman County, Washington. Even along the point of contact there is practically no intermingling of the two species of the region.

In the original description, mention is made of the "dimorphism" of the stamens, in which it is stated that there are many plants with six long stamens, many with six short stamens and others with three long and three short ones. This seems to be based upon a misunderstanding of the behavior of the anthers in their various stages of development. In all of the species of the genus with which I am familiar, in the bud and up to about the time of anthesis, or sometimes a little later, the anthers are all long and of equal length; later the three outer ones dehisce and shrink to about half their original length, at which time there are, obviously, three long and three short anthers; finally the inner set goes through the same process, when, of course, there are six short anthers. The original length can usually be restored by soaking. Also the filaments are described as being "usually of equal length, but sometimes three distinctly longer." Normally in the genus they are in two sets, of equal length in each set, the outer being the shorter, the only exception among our western species being *E. grandiflorum* var. *pallidum* St. John. In the type region of *E. idahoense,* I made careful measurements of many sets of filaments, and found them quite constantly regular, the difference in length of the two sets being rather uniformly 2 mm.

The authors in describing the species, state that it is more similar to *E. montanum* S. Wats. than it is to *E. grandiflorum* Pursh. The resemblance I am inclined to think, is more superficial than otherwise. No point of similarity is mentioned other than color of perianth, and even this is only partly true. On the other hand, attention is called to the striking difference in leaf form, and in geographic and zonal distribution. *E. grandiflorum* and *E. idahoense* are practically identical morphologically and in general aspect and habit. The only marked difference is in color of flower. This, however, is very constant as color differences usually are in the genus, and the two species while sometimes growing in more or less close proximity, are apparently always found in separate colonies. While *E. idahoense* more commonly has an oblanceolate leaf, and that of *E. grandiflorum* is more often lanceolate, the difference is by no means constant. *E. montanum* is truly subalpine, with a leaf characteristically different from all of our other western forms, and with the color areas of the perianth segments sharply defined, in strong contrast to the condition in all of the members of the *E. grandiflorum* group.

It is interesting to record here that Charles A. Geyer, then a most courageous and remarkable young German botanist, collected in the Coeur d' Alene region and southward to the Clear-

water country during the early part of the season of 1844, having with great difficulty and danger made his way alone across the Rocky Mountains during the previous winter. In the Herbarium at Kew is a well preserved set of his number *601,* a collection to which he gave the manuscript name *E. pallidum.* Accompanying this is the following note: "Abundant in the Coeur d' Alene Mountains on grassy slopes of the hills close to the valley, rare southward. The adjoining Spokane country abounds with a more beautiful bright golden-yellow species with brown anthers, much longer." (The last, of course, is *E. grandiflorum* Pursh.) Although referred to that species by Hooker in his list of Geyer's plants, it would seem by inference to be *E. idahoense,* the species common in the region referred to by Geyer, although it might be *E. grandiflorum* var. *pallidum* St. John. This, however, does not seem likely, in view of the fact that all of the anther-color forms of that species have the same yellow perianth color. Geyer's reference to the "golden-yellow" of the Spokane plant in contrast to his *"601"* with his manuscript name *"pallidum,"* would seem to indicate the white flowered plant. Recently I examined specimens of this collection (*Geyer 601*) which were distributed to the Gray Herbarium of Harvard University. I am indebted to Mrs. R. S. Ferris of the Dudley Herbarium of Stanford University for an excellent photograph of specimens of this collection which she secured for me at Kew Herbarium. While it is difficult to determine with certainty the various forms of this group, from herbarium specimens, I should say that Geyer's plant is the earliest collection of *E. idahoense* St. John & Jones.

The beginning of Geyer's narrative will be found in the London Journal of Botany (vol. 4: 479. 1845). The catalogue of his plants appears later in the same publication and is concluded in Hooker's Journal of Botany (vol. 3: 287. 1851).

Specimens examined. Idaho. Kootenai County: Worley, 21 March 1926, *St. John, English, Jones, Ransom & Ridout 3719* (WS, type), 25 April 1926 (fr.), *St. John, Gessell, Jones, Ridout & Woods 4255* (WS); near Worley, 17 April 1923, *Nettie M. Cook* (WS); Coeur d' Alene, 24 May 1923, *Nettie M. Cook* (WS). Benewah County: Lovell, 21 March 1926, *St. John, English, Jones, Ransom & Ridout 3730* (WS). Latah County: 5 miles east of Harvard, 18 April 1926, *Georgina Burke,* (WS). Washington. Pend Oreille County: Tiger, 29 April 1925, *E. E. Hupp* (WS); Molybdenite Mountain, 16 May 1925, *St. John, Pickett, Davidson & Warren 3741* (WS), 5 June 1926, *W. F. Hagemyer* (WS). Spokane County: Waverly, 19 April 1928, *J. H. Snyder* (WS, PhA, GH). Whitman County: Steptoe Butte, 6 April 1906, *J. W. Hungate* (WS, isotype and US, type of *E. grandiflorum candidum* Piper). Shoshone County: "Coeur d' Alene Mountains," 1844, *Geyer 601* (GH).

Erythronium idahoense forma *tricolor* St. John, Research Stud. St. Coll. Wash. 1: 95. 1929: in my field investigations covering all known western forms of *Erythronium,* I have found many con-

tacts between various species. Usually there are unmistakable indications of hybridization. These consist of color changes and various malformations of flower parts. Hence I am inclined to believe that this form is the result of a cross between *E. idahoense* St. John & Jones and *E. grandiflorum* Pursh. Dr. St. John himself suggests this possibility. I examined the type at the Washington State College, Pullman, where it is deposited.

7. Erythronium montanum S. Wats. Proc. Am. Acad. 26: 130. 1891.

Corm rather slender, about 3.5 cm. long, 4–5 mm. thick, the button-like scars of old corms retained in a crowded chain for a number of years, even 10 to 15; leaves 10–15 cm. long, 1–2 cm. broad, often with little difference in width of the two, commonly broad- to ovate-lanceolate (rarely ovate, subcordate), acute, usually abruptly narrowed to a slender, nearly wingless petiole, this frequently almost as long as the blade; scape 15–30 cm. high, or even higher sometimes, bearing frequently only a single flower, but often several; the perianth segments pure white except for the lower part of the narrow base of pure plain yellow, the color areas well defined, the outer segments sometimes streaked with pink without, delicate in texture, lanceolate to rather broadly lanceolate, acuminate, sharply acute, 25–40 mm. long, 7–10 mm. broad (frequently larger); the median pair of appendages well devolped inflated, closed sacs, the auricles folded into a separate ridge; filaments very slender and of nearly or quite uniform thickness; anthers golden-yellow; style slender, scarcely enlarged above; stigma lobes only moderately long and somewhat tardily recurving; capsule 2.5–3 cm. long, about 12 mm. thick, long obovate with cuneate base and retuse apex.

This species has the most distinctive leaf of any of our western forms. With its usually broad blade, abruptly narrowed and sometimes subcordate base, long slender petiole and evenly acute apex, it is suggestive of that of the old world type.

Founded on the following: "On the high mountains of Oregon and Washington (Mt. Hood, Mt. Adams, etc.); *Mrs. P. G. Barrett, Howell and Suksdorf;* in flower from July to September." Type collected by Thomas Howell 601 on the north slope of Mt. Hood, 1 August 1886, the exact station probably at or in the vicinity of Elk Cove, along the trail west of Cloud Cap Inn, at about 5500 feet altitude.

Distribution: Canadian and Hudsonian zones, on Mount Hood and vicinity in the northern Cascade Mountains of Oregon, northward on the high peaks of the Cascade and Olympic mountains of Washington, and the higher parts of the mountains of Vancouver Island, British Columbia. The center of greatest abundance is on Mt. Rainier, where in Paradise Valley and similar localities, very extensive colonies are found. On Mt. Hood, smaller but most attractive colonies occur among the snow-

banks near the foot of glaciers, in openings in the forests of fir, hemlock and white barked pine; and often associated with *E. grandiflorum* var. *pallidum* St. John. No hybrids between these two species have been noted.

Specimens collected. Washington. Pierce County: Paradise Valley, Mt. Rainier, 9 August 1926, *4886, 4890, 4891.* Oregon. Hood River County: Elk Cove trail, north slope of Mt. Hood, 14 August 1932, *8250;* Elk Cove, 15 August 1932, *8259, 8274.*

Specimens examined. Oregon. Hood River County: Mt. Hood, 5 August 1926, *Carl English Jr.* (WS); north side of Mt. Hood, 1 August 1886, *Thos. Howell 601* (UO, NY, GH, type); 22 August 1895, *Howell 1523* (UC, UO, NY, US); 4 August 1927, *J. W. Thompson 3386* (DH); 10 August 1893, *Howell* (UC); Lost Lake, Mt. Hood, 26 June 1921, *Peck 9889* (DH, NY); Mt. Hood, 29 July 1886, *Howell 1031* (US); 1882, *Mrs. P. G. Barrett 36* (GH, cotype). Multnomah County: Larch Mountain, 19 June 1927, *J. W. Thompson 2717* (DH, GH). Washington. Pierce County: Mt. Rainier, 23 July 1894, *O. D. Allen 82* (UC, WS, DH); 20 August 1892, *Allen 12* (GH); Round's Pass, Mt. Rainier, 29 June 1927, *F. A. Warren 642* (WS); Sluiskan Falls, Mt. Rainier, 22 June 1926, *Warren* (WS); Mt. Rainier, *J. B. Tarleton 81* (UC), August 1928, *H. E. and S. T. Parks 21055* (UC, GH); 1882, *Brandegee* (UC); *L. R. Abrams 9011* (DH, NY); 25 July 1905, *Dudley* (DH); 29 July 1905, *Sheldon 13216* (DH); 1894, *Rev. Thompson* (DH); 4 July 1926, *Miss Dobie* (DH); 1 August 1895, *Piper 193* (WS); 1 August 1896, *J. B. Fleet 256* (WS); 1899, *Fleet* (US); 23 August 1923, *St. John 3744* (WS); July 1917, *Mrs. S. E. Kelley* (CA); 4 August 1914, *Alice Eastwood* (CA); July 1913, *Julia McDonald* (CA); July 1924, *M. S. Baker* (CA); August 1895, *Bailey Willis* (US); August 1895, *Piper 2118* (US, GH); 11 August 1928, *Heller 14767* (NY, US); 22 July 1930, *Lyman Benson 2301* (NY); July 1905, *M. W. Lyon Jr. 126* (US); 12 August 1909, *A. S. Foster 1083* (PhA); August 1897, *C. Hart Merriam* (US); 17 July 1907, *H. C. Cowles 691* (GH); Goat Mountain, Mt. Rainier, 26 July 1894, *Allen 83* (NY, US, GH). Skamania County: Mt. Adams, 25 July 1884, *Suksdorf* (UC, US, GH, cotype); near Mt. Adams, 3 August 1892, *Henderson* (WS); Mt. Adams, 11 August 1894, *F. E. Lloyd* (NY); Mt. St. Helens, 20 July 1898, *Coville 830* (US). Clallam County: Olympic Mountains, June 1900, *Elmer 2496* (DH, UO, NY, US); Sol Duc, 25 August 1921, *St. John 3742,* (WS); Bagachiel Peak, *I. C. Otis 1339* (WS, CA); Elwha River, 28 August 1921, *St. John 3743* (WS); Sol Duc, August 1912, *C. F. Newcomb* (PM); Olympic Mountains, 6 August 1928, *Mr. & Mrs. Leach* (UO); August 1895, *Piper 2220* (WS, GH). Jefferson County: Olympic Mountains, 13 July 1895, *Henderson 2038* (GH). Grays Harbor County: Mt. Baldy, 8 July 1902, *H. S. Conard 284* (NY, US, GH); 25 July 1897, *F. H. Lamb 1359* (NY). British Columbia. Vancouver Island: Mount Washington, 13 July 1928, *Mrs. Mundy* (PM).

8. Erythronium Howellii S. Wats. Proc. Am. Acad. 22: 480. 1887.

Inner perianth segment bases narrow and entirely destitute of any kind of appendages, that is, naked; otherwise apparently identical with *E. citrinum* S. Wats. which occupies the territory immediately to the north and west.

For a number of seasons I have made field examinations of these two forms, covering practically their entire range in considerable detail, without being able to find any other distinguishing characters. In a search for contacts between the two, I found a colony on the west fork of the Illinois River west of Waldo, the type locality of *E. Howellii,* in which a considerable proportion of the plants had purplish anthers, suggesting hybridization. Upon closer examination of many plants, I found both forms intermingled, together with intermediate forms with appendages in various stages of development.

Concerning the processes on the perianth segments, it would seem that their value as specific diagnostic characters does not necessarily depend upon their size and conspicuousness. However trivial and inconvenient they may appear at first sight, they are at least definite and constant within the various species having them.

Type in the Gray Herbarium of Harvard University, collected at "Waldo, Josephine County, April 24, 1887, Thomas Howell 658." Named for the veteran Oregon botanist, Thomas Howell, author of the "Flora of Northwest America."

Distribution: the south end of the valley of the Illinois River, southern Josephine County, Oregon, for the most part the region lying within the east and the west forks of the Illinois River, southward into the lower elevations of the Siskiyou Mountains; Transition Zone. Also reported from Del Norte and Siskiyou counties, California, but thus far I have found only *E. citrinum* S. Wats. in all of the localities mentioned in these two counties. All the specimens examined from them labeled *E. Howellii* have proved to be of that species. The species is also listed in various publications as occurring on Vancouver Island. This seems highly improbable. In my field work there, and investigations at the Provincial Museum at Victoria, and at the University of British Columbia, I could find nothing to confirm the reports.

Specimens collected. Oregon. Josephine County: Waldo, 9 April 1925, *4178;* near Waldo, 10 April 1925, *4181;* near and south of Waldo, 10 April 1925, *4182;* 3 miles north of Waldo, 10 April 1925, *4188;* 6 miles north of Waldo, 10 April 1925, *4190;* Waldo, 20 April 1932, *7071;* Waldo, 7 April 1933.

Specimens examined. Oregon. Josephine County: Waldo, 24 April 1887, *Thomas Howell 658* (GH, type); April 1892, *Howell 1280* (UC); April 1925, *Henderson* (CA); 16 March 1926, *Henderson 5788* (DH, CA); near Waldo, 25 April 1887, *Howell* (UC, US); Takilma, 21 April 1929, *Doris Kildale 7410* (DH);

near Waldo, 6 May 1923, *Henderson* (PhA); Waldo, April 1923, *M. S. Baker 7416.*

9. Erythronium citrinum S. Wats. Proc. Am. Acad. 22: 480. 1887.

Corm slender, about 5–7 cm. long, 1–1.5 cm. thick; leaves 10–15 cm. long, 1.5–3.5 cm. broad, lanceolate to oblong-lanceolate, acute to acutish, occasionally obtuse, especially the larger; petiole from short and broadly winged to long and slender; scapes 10–25 cm. high, often bearing several flowers, either approximate or distant, sometimes the stem branching from a common point above the leaves; perianth segments white to creamy-white with light lemon-yellow base, either plain or irregularly splotched and broken by a paler transverse band, greenish-yellow with sometimes a tinge of pink without, 25–40 mm. long, 6–8 mm. broad; appendages moderately well developed, the median pair globular, inflated sacs, the auricles with margins turned back to form an open cup-like sac, resembling the closed ones but smaller; filaments slender and attenuate; anthers white, blunt; style usually rather stout and clavate, commonly 6–8 mm. long; stigma shortly to very obscurely lobed; capsule long-obovoid, rounded or abruptly narrowed at apex.

Distribution: common in chaparral and open oak and yellow pine woods, Transition Zone. Slate Creek of lower Applegate River watershed, southward through the Deer Creek hills and the Illinois River Valley to the south fork of the Illinois, thence along the valley of the west fork into the Siskiyou Mountains, Josephine County, Oregon; along Smith River, Del Norte County, and the Klamath and Scott River regions into Quartz Valley, Siskiyou County, California. Replaced on the southerly slope of the Trinity Mountains by *E. californicum* Purdy.

Type in the Gray Herbarium, collected "In the Deer Creek Mountains, Josephine County, Oregon, April 24, 1887, Thomas Howell 657."

Specimens collected. Oregon. Josephine County: Butcherknife Creek, 9 April 1925, *4175;* Kerby, 10 April 1925, *4194;* Deer Creek, 11 April 1925, *4198;* near Kerby, 11 April 1925, *4196;* Eight Dollar Mountain, 11 April 1925, *4197;* Hayes Hill grade, 11 April 1925, *4199, 4200;* Welter Mill, Butcherknife Creek, 11 April 1925, *4215;* Eight Dollar Mountain, 14 June 1929, *5714;* Hayes Hill, 4 April 1931, *6641;* north of Kerby, 4 April 1931, *6644;* near Selma, 4 April 1931, *6645;* Hayes Hill, 20 April 1932, *7072;* 7 April 1933, *8309;* Slate Creek, *8313.* California. Del Norte County: Adams Station, Smith River, 29 March 1931, *6628.* Siskiyou County: Quartz Valley, near Ft. Jones, 15 April 1932, *7059;* Klamath River opposite mouth of Doggett Creek, 16 April 1932, *7061;* near Hamburg, Klamath River, 16 April 1932, *7062.*

Specimens examined. Oregon. Josephine County: Eight Dollar Mountain, 11 March (fl.), 16 June (fr.) 1926, *Henderson 5786* (DH, UC, CA, UO); near Selma, 13 April 1927, *J. W. Thompson 2283* (DH), 29 April 1928, *Mrs. Gale 25* (DH, PhA); west fork Illinois River, 21 April 1929, *Doris Kildale 7391* (DH); Mendenhall Creek, 20 April 1929, *Kildale 7326* (DH); Hayes Hill, 22 March 1925, *Sweetser, Henderson & Savage* (UO); Slate Creek, 5 May 1923, *Sweetser* (UC); Kerby, 3 May 1923, *Sweetser* (UC); near Deer Creek, 26 April 1887, *Thos. Howell* (UC, US); Anderson's, April 1892, *Howell 1281* (UC, US); Loves Station, 19 April 1905, *M. S. Baker* (UC); Deer Creek Mountains, 24 April 1887, *Thomas Howell 657* (GH, type); Mt. Grayback, 15 June 1904, *Piper 6232* (GH, US); Hayes Hill, 5 May 1923, *Henderson* (PhA); Kerby, 22 March 1927, *M. E. Peck 14737* (PhA). California. Siskiyou County: Quartz Valley, 24 April 1909, *Geo. D. Butler 661* (DH, UC). Del Norte County: Adams Station, 29 March 1928, *Alice Eastwood 15056* (UC, CA, US); near Patrick Creek, 22 April 1907, *Eastwood 71* (US).

10. Erythronium Hendersonii S. Wats. Proc. Am. Acad. 22: 479. 1887.

Corm 4–6 cm. long, 1–1.5 cm. thick, rarely multiplying by sessile offsets; leaves 10–20 cm. long, 1.5–5 cm. broad, lanceolate to broadly lanceolate, acute (the larger often obtuse), petiole long and slender or shorter and broadly winged; scape purplish, sometimes branching from a common point above the leaves, or more or less distantly, rarely as many as 10–12 branches closely approximate; perianth segments from light to dark lavender, the bases very dark purple within, surrounded by a white or yellowish zone, the upper edge sharply toothed, lanceolate, acuminate to broadly lanceolate, bluntish and cuculate, 25–40 mm. long, 6–8 mm. broad, the appendages conspicuous, closed, globularly inflated sacs, the median pair larger and more inflated, the lateral ones covering the auricles; filaments purple, slender and attenuate; anthers buff or straw-colored with brown center line; style purple, often little longer than the purple ovary, stout, strongly clavate; stigma practically entire or obscurely lobed or toothed; capsule obovoid to ellipsoid, 3–4 cm. long, 2 cm. thick.

Type in Gray Herbarium of Harvard University, collected by L. F. Henderson, near Ashland, Jackson County, Oregon, April, 1887. Cotype collected by Thomas Howell, Grants Pass, Josephine County, Oregon, the same month.

This is the first *Erythronium* with which I became acquainted, the type locality being my birthplace and early home. During the early period of my interest in these beautiful plants, this species, as well as most of the others of southwestern Oregon and northwestern California, were as yet unnamed. It is a matter of satisfaction to note that the species here discussed

fittingly bears the name of my friend Professor L. F. Henderson, now curator of the herbarium of the university of my native state.

Distribution: throughout the Transition Zone in the Rogue River hills from Wolf Creek, Josephine County, near the southern boundary of Douglas County, Oregon, southward through the Rogue River Valley, Josephine and Jackson counties, across the Siskiyou Mountain pass in the vicinity of Pilot Rock, into the valley of the Klamath River, California, southward to the south fork of Salmon River, Scott Mountains, southern Siskiyou County; eastward from Rogue River Valley into the yellow pine region of the Cascade Mountains to Jenny Creek, a tributary of the Klamath River, nearly to the western boundary of Klamath County, Oregon; and westward throughout the greater part of the valley of the Applegate River, Jackson and Josephine counties, Oregon. The altitudinal range is from about 1500 feet to 5000 feet on exposed slopes.

Erythronium Hendersonii is very similar morphologically to *E. Howellii* S. Wats. and *E. citrinum* S. Wats., but strikingly different in color, and usually having a shorter style with a more constantly entire stigma.

At all of the regions of contact with the following species well marked hybrids were found: *E. oregonum* Applegate and *E. citrinum* S. Wats. on Slate Creek, eastern Josephine County; *E. oregonum* subsp. *leucandrum* Applegate, Evans Creek, Jackson County; *E. klamathense* Applegate, Keene Creek Prairie, Cascade Mountains, Jackson County. The species was found also on the Klamath River near Hamburg, Siskiyou County, California, with *E. citrinum* S. Wats. Here no hybrids were noted.

In cultivation, the tendency to reproduce by multiplication of corms from the base of the old ones is greatly stimulated by irrigation, a single corm gradually producing by sessile offsets a clump or bed, instead of becoming dormant as the ground dries under natural conditions. This tendency has been observed in a number of other species, and is perhaps true, to a greater or less degree, in the genus. *Erythronium tuolumnense* Applegate is the only species habitually to reproduce in nature in this manner; while *E. helenae* Applegate does so less freely under the most favorable soil and moisture conditions, and to a remarkable degree in cultivation.

Specimens collected. Oregon. Jackson County: Carter Creek, Siskiyou Mountains, 30 May 1895, *710a;* Sampson Creek, Cascade Mountains, 1 June 1895, *710;* Siskiyou Mountains south of Ashland, 20 May 1898, *2237;* Jenny Creek, 11 May 1924, *4048;* Keene Creek, 11 May 1924, *4081;* Keene Creek ridge, 22 May 1924, *4081;* Emigrant Creek, 7 April 1925, *4149;* Little Applegate River near Ruch, 11 April 1925, *4219;* Snow Mountain, Siskiyou Mountains, 9 June 1925, *4364, 4366;* Jenny Creek,

25 May 1925, *4288;* Corral Creek, 27 May 1925, *4343;* Chinquapin Mountain, 27 May 1925, *4340a;* confluence of Corral and Beaver creeks, 21 June 1925, *4378;* Tolman Springs, Siskiyou Mountains, 28 March 1926, *4576;* Tyler Creek, 29 March 1926, *4584;* Sterling Creek, Applegate Valley, 6 April 1926, *4597;* Grizzly Butte, 19 May 1926, *4634;* south slope of Siskiyou Mountains, 26 April 1928, *5402;* Pilot Rock, Siskiyou Mountains, 18 June 1928, *5542;* Keene Creek, 30 April 1930, *6150;* Trail Creek, Rogue River, 29 April 1930, *6149;* Evans Creek near Wimer, 21 April 1932, *7076;* Evans Creek, 21 April 1932, *7077, 7080.* Josephine County: near Gold Hill, Rogue River, 8 April 1925, *4136;* Rogue River near Grants Pass, 9 April 1925, *4168;* near Grants Pass, 9 April 1925, *4170;* Applegate River, 11 April 1925, *4216;* between Grave and Wolf creeks, 6 April 1931, *6649;* near Wolf Creek, 2 April 1931, *6638;* west fork of Williams Creek, 18 April 1932, *7069;* Slate Creek, 7 April 1933, *8312;* west fork Williams Creek, 11 April 1933, *8315;* Cedar Flat trail, Siskiyou Mountains, 6 July 1933, *8735.* California. Siskiyou County: Klamath River between Seiad Valley and Hamburg, 16 April 1932, *7063.*

Specimens examined. Oregon. Jackson County: highway, Siskiyou Mountains, 9 May 1924, *Abrams & Benson 10178* (DH, PhA); 29 April 1928, *Mrs. Gale 13* (DH, PhA); *and 77* (PhA, US); Wimer, Evans Creek, 11 April 1893, *E. W. Hammond 387* (UC, CA, PhA, NY, US); Medford, 30 April 1929, *Ada T. Klocker* (CA); Jacksonville, 7 April 1913, *L. E. Smith 44* (CA); Ashland hills, 22 April 1930 (fl.), 15 June (fr.), *Henderson 5787* (PhA); Siskiyou Mountains south of Ashland, 22 May 1898, *Applegate 2237* (US); Grizzly Peak, 22 June 1899, *J. B. Leiberg 4141* (US); Sampson Creek, 1 June 1895, *Applegate 710* (US); Ashland, April 1887, *Henderson* (GH, type). Josephine County: near Grants Pass, 27 March 1929, *Lyman Benson 1089* (DH); Wilderville, 29 April 1929, *Doris Kildale 7586* (DH); Sexton Mountain, 28 April 1928, *Mrs. Gale 40* (DH, PhA, US); Thompson Creek, Applegate Valley, 10 May 1924, *Abrams & Benson 10302* (DH); Grants Pass, 28 March 1913, *Lois Dale* (DH); 7 March 1926, *Henderson 5787* (DH, CA); 18 April 1905, *M. S. Baker* (UC); 20 April 1887, *Howell 1280* (UC, NY, US); near Grants Pass, April 1913, *L. E. Smith* (CA, US, GH); Woodville, 1 April 1889, *Jos. Howell* (PhA); Grants Pass, 10 April 1887, *Thomas Howell 656* (GH, cotype); Cascade Mountains, 1893, *Mrs. R. M. Austin* (GH); between Provolt and Murphy, 11 April 1933, *M. S. Baker 7359.* California. Siskiyou County: Cecilville, Scotts Mountains, 27 April 1929, *Doris Kildale 7489* (DH); Hilt, 25 April 1917, *Mrs. A. E. Stonehouse* (CA).

11. Erythronium revolutum Smith, in Rees' Cyclop. 13: no. 3, 1809. *Erythronium grandiflorum* var. *Smithii* Hook. Fl. Bor. Am. 2: 182. 1840. *Erythronium revolutum* var. *Bolanderi* S. Wats.

Proc. Am. Acad. 26: 129. 1891, in part (see *E. californicum* Purdy). *Erythronium Smithii* Orcutt, West Am. Sci. 7: 129. 1891. *Erythronium revolutum* var. *Johnsonii* Purdy, in Bailey Cyclop. Hort. 548. 1900.

Corm 3–5 cm. long, 5 mm. thick, often the remains of old corms retained in a crowded rhizome-like chain for a number of years; leaves commonly broadly-lanceolate, the widest part near the middle of the blade, acute, the larger sometimes obtuse, rather shortly attenuate to a narrowly winged petiole, 15–20 cm. long, 3–6 cm. broad; scape 15–40 cm. high, those bearing several flowers often flattish and ribbed above, appearing partly fasciate; flowers usually one, sometimes two or three, rarely more, the segments linear-lanceolate, acuminate, acute or sometimes blunt and cucullate, frequently with involute margins, 35–45 mm. long, 7–10 mm. broad (sometimes larger), rich rose-pink without, lighter within, especially the base which is broken by one or two interrupted yellow transverse bands, the outer base usually darker; the median pair of appendages conspicuous, elongate, not strongly inflated, the lateral ones small if present, often reduced to a ridge-like fold of the well developed auricles; filaments very broadly dilated below, 3–4 mm. wide, enveloping the ovary, subulate; anthers golden-yellow, usually closely appressed to the style; style long and filiform, only slightly enlarged above; stigma deeply divided, the lobes strongly recurved; capsule oblong or sometimes slightly attenuate downward, blunt with abruptly narrowed base, 3–4 cm. long, 5 mm. thick.

Distribution: frequent along the coast in openings in forests, margins of swamps and bogs, and along wooded streams; from the Navarro River in the redwoods, southern Mendocino County, California, about 39 degrees north latitude, northward through northern California, Oregon, Washington and southern British Columbia, where it occurs on both sides of Vancouver Island and on the mainland as far north as Kingcome Inlet, latitude about 51 degrees, a distance of over 800 miles. Confined to the humid Transition Zone, and, with rare exceptions, to low altitudes and within perhaps 20 miles of the seacoast. On the Hupa Indian Reservation, northern Mendocino County, California, collections have been made at 2500 to 3500 feet and some 30 miles inland; and in Curry County, Oregon, 15 miles from the coast at about the same altitude. It reaches its greatest development and abundance along the northern coast of Oregon, the region of maximum rainfall. Here I have seen plants 18 inches high with flowers as large as 5 inches across, dark, rich rose-pink in color. In most colonies throughout the range of the species, occasional white individuals occur. This tendency to albinism is more pronounced toward the south end of the range. Otherwise there is remarkable uniformity in

color, basal segment configuration, and morphology. There are certainly no variations worthy of names.

A discrepancy has been noted concerning the date of original publication in Rees' Cyclopedia, some authors giving 1819, others 1809. According to B. D. Jackson (Jour. Bot. 34: 310), the complete set of 39 volumes was issued in 1819, but was published in parts, the one containing *Erythronium* being issued in 1809, making it the earliest publication of our western species of *Erythronium,* antedating *E. grandiflorum* Pursh by 6 years.

Specimens collected. British Columbia. Vancouver Island: Courtenay, Comox Bay, 18 April 1931, *6666;* Cole Creek, west of Sooke, 20 April 1931, *6671;* Simpson's gardens, Cowichan Lake, 17 April 1931, *6665.* Oregon. Clatsop County: near Nehalem River, 10 April 1931, *6658.* Tillamook County: near Salmon River, 10 April 1931, *6657;* Limestone Creek, near Blaine, 9 April 1931, *6656.* Lincoln County: near Toledo, 8 April 1931, *6655;* near Eddyville, Little Elk River, 8 April 1931, *6653;* Yaquina River, near Chitwood, 8 April 1931, *6654.* California. Del Norte County: Adams Station, Smith River, 29 March 1931, *6629* and 25 July 1931, *6811* (fruit); Gasquet, 23 April 1930, *6132.* Mendocino County: Leggett Valley, 27 March 1931, *6622;* Navarro River, 19 March 1932, *7019;* McCoy Creek near Garberville, 5 April 1933, *8308.*

Specimens examined. British Columbia. Vancouver Island: Coal Creek, 21 April 1924, *G. French 7424* (PM); Henderson Lake, 14 June 1916, *W. A. Newcomb 988* (PM, WS); Henderson Lake, 6 April 1916, *C. F. Newcomb* (PM); Ucluelet, Barklay Sound, 2 May 1916, *George Fraser* (PM); Alberni, 27 April 1917, *W. R. Carter* (PM); Alberni, 28 May 1921, *C. F. Newcomb* (PM); Valdez Island, May 1920, *C. F. Newcomb* (PM); Port Rupert, May 1913, *W. R. Carter* (PM); Anderson Lake, west coast, June 1916, *J. P. Babcock* (CA); Effingham Bay, near Ucluelet, 6 May 1909, *John Macoun* (NY); Alberni, May 1915, *W. R. Carter 161* (GH); Alberni, 27 April 1917, *W. R. Carter* (NY). Mainland: Kingcome Inlet, 5 August 1917, *C. F. Newcomb* (PM). Washington. Jefferson County: Hoh River, 19 April 1925, *I. C. Otis 1418* (WS). Clallam County: near Lake Tyee, 29 April 1925, *I. C. Otis 1426* (WS); Forks, 30 April 1925, *I. C. Otis 1428* (WS). Oregon. Clatsop County: Neahkahnie, 23 April 1920, *W. H. Gorman* (DH). Tillamook County: Nescowin, 22 April 1924, *Mrs. C. E. Evans* (CA); near Tillamook, 21 May 1928, *J. W. Thompson 4113* (DH, OS, US, PhA, NY); Tillamook, 21 April 1920, *Bradshaw 1378* (DH); 31 March 1896, *W. R. Cannon* (NY). Lincoln County: Toledo, 1 April 1924, *L. M. Haskin* (DH); 25 March, *L. M. Haskin* (OS); near Newport, 19 March 1925, *Miss Aiken* (UO); near Chitwood, 22 April 1927, *Fern Duncan* (OS). Curry County: near Brookings, 14 March, *Hatfield* (UO, UC); Carpenterville, 5 June 1929 (fr.), *Henderson 10137* (UO); Snow Camp, 27 April 1931, *Mrs. Leach 3261.*

California. Del Norte County: Adams Station, Smith River, 29 March 1928, *Alice Eastwood 15057* (UC, CA). Humboldt County: Hoopa Indian Reservation, June 1901, *Chandler 1279* (DH, UC, NY, US, GH); Kneeland Prairie, 21 March 1926, *Doris Kildale 1560* (DH); 9 June 1908, *Tracy* (UC, UO); 4 May 1907, *Ethel Tracy* (UC); 4 May 1913, *J. P. Tracy 4059* (NY, US). Mendocino County: redwoods, 1866, *Bolander 4709* (UC, GH, US); Comptche, 1897, *Purdy* (UC); near Navarro River, 19 March 1932, *M. S. Baker 5645* (UC, CA); April 1929, *Mrs. Horstman* (CA).

The Otis collections cited above, are the first recorded from the state of Washington, an account of which was published by Dr. St. John in 1929 (Research Stud. St. Col. Wash. 1: 59). They are deposited in the herbarium of the State College of Washington, Pullman, where I examined them in May, 1931. They are excellent specimens, leaving no doubt as to their identity.

This species is not only of special interest because of its being the first of our western forms collected and named, but by reason of the important and stirring historical events associated with its discovery, in which the sovereignty of the whole Northwest Territory was involved, and in which all of the leading maritime powers of the world were actors. Nootka Sound, because of its excellent harbor and favorable location, was the rendezvous of the explorers and fur traders of the time.

There has been more or less uncertainty concerning the identity and date of the discovery of this plant, but the evidence seems to point to the conclusion that the first specimens were collected in 1793 by the celebrated Scotch physician and naturalist, Archibald Menzies, in the vicinity of Nootka Sound, Vancouver Island. Menzies, as early as 1787, on the English trading ship, "The Prince of Wales," under the command of Captain Colnet, botanized along the northwest coast and again later, on the "Discovery" with Captain George Vancouver on his famous exploring voyages for the British government. Concerning the date of this collection, we can only infer from the circumstances surrounding Menzies' activities during these various voyages. Four visits were made to Nootka (King George's) Sound: in July, 1787; some time in 1788; in August, 1792; and during the month of May, 1793. On the last visit he spent the 21st day of May botanizing, as an entry in his journal shows. The 1787 and 1792 visits were of course too late in the season for flowering specimens of this plant. While no journal of Menzies for the year 1788 has been found, in his journal for 1793 is an entry written at Nootka in which he refers to certain events which took place there "about five years before." This reference establishes the fact that he did collect plants there during the season of 1788; he may have been there that year at the right time to collect flowering plants of *Erythronium*.

During the spring of 1931, my wife and I spent some time on Vancouver Island and the adjacent mainland collecting *Erythronium* and examining material and historical data at the University of British Columbia at Vancouver and at the herbarium of the Provincial Museum at Victoria. At the latter institution, Mr. W. A. Newcomb, Curator, furnished me with much interesting and useful information concerning this species, and later was good enough to secure for me fine specimens from the type locality. These were collected at Friendly Cove, Nootka, by Rev. Father Anthony Terhaar, 7 April 1934. Concerning the date Mr. Newcomb writes: "The flowering season for 1934 has been in many cases fully a month early, which should be noted when comparing with Menzies' dates."

Recently I have had the good fortune to be able to examine Menzies' original collection, deposited in the Kew Herbarium. For the loan of this type I am very greatly indebted to Sir Arthur W. Hill, Director of the Royal Botanic Gardens at Kew. The type sheet holds three separate collections, the one on the right side being the type. Although showing the ravages of nearly a century and a half's time, enough remains to show clearly its identity with the pink *Erythronium* of Nootka Sound. By slightly raising a segment which covers the stamens, the broad subulate filaments, which alone sufficiently characterize the species, can be plainly noted. But even without this examination of the plant, the locality would be sufficient for its identification since there is only one species in the Nootka region, and since there is no reason to doubt that it was collected there by Menzies. Directly under the specimen is written: "*E. revolutum* Smith, Rees' Cyclop. *Erythronium grandiflorum* Ph. [The last specific name added in pencil.] fl. rubr. purp. Kg. George's Sound. A. Menzies, V. I., N. America." [The part following the initials written in pencil.] Other annotations have been added by various botanists even down to the present year, 1935. Next to the type is a specimen evidently of the species named in this paper *E. oregonum.* It bears evidence of having been soaked up for critical examination and may have been a contributing factor to the confusion between the two species mentioned farther on. There is nothing to indicate by whom or where the plant was collected. The third specimen on the sheet bears the label: "*Erythronium revolutum,* Kew Gardens, April 9, 1897. Named by Mr. Baker."

Many references to this Menzies collection are made by botanical writers. In 1840 Hooker (Fl. Bor. Am. 2: 182) published *E. revolutum* as a variety of *E. grandiflorum* Pursh, concerning which he adds this note: "It will be seen that the indefatigable and venerable Menzies was the first to discover this fine and very distinct species, though he only appears to have found a pale purple-flowered variety." This variety Hooker names *E. grandiflorum* var. *Smithii,* notwithstanding the fact that

he says it is the same as *E. revolutum* Smith. With the same inconsistency, while recognizing *E. revolutum* as the older name, he retains *grandiflorum* as the specific name under which he places his three varieties, *Smithii, giganteum,* and *albiflorum.*

Since Hooker's time, while there has been general agreement that Menzies' Nootka plant is the type of *E. revolutum* Smith, some botanical writers who have concerned themselves with the genus have been more or less confused as to the identity of the plant itself. Even as eminent a botanist as J. G. Baker (Gard. Chron. 1876: 138), giving correct diagnosis and habitat, unhesitatingly refers specimens of *E. purpurascens* S. Wats. to *E. revolutum,* after comparing them with the Menzies specimen at Kew which he considers the type. Then some twenty years later (Gard. Chron. 1897: 299) he writes: "Mr. R. Wallace, of Colchester, has lately brought me fine living plants of an Erythronium I was very pleased to see. It has flowers as large and peduncles as tall as in E. giganteum (*Bot. Mag.,* t. 5714), but the flowers are bright mauve-purple instead of creamy-white. The leaves are conspicuously mottled, and the style distinctly tricuspidate, with three falcate stigmas. It agrees with E. revolutum of Smith, described in 1819 [1809] in the thirteenth volume of the *Cyclopedia or Universal Dictionary of Arts, Sciences, and Literature,* edited by Dr. Abraham Rees, F. R. S., F. L. S. This plant was collected by Menzies in Vancouver's Island. . . ." Here he paradoxically makes two distinctly different things equal to the same thing. Farther along, referring to Watson's revision of the genus (1891), he says: "He does not seem to have been acquainted with the genuine E. revolutum, but describes an E. revolutum var. Bolanderi, to which the plant now cultivated by Mr. Wallace and others, under the name of E. Smithii, seems to belong." In Macoun's Catalogue of Canadian Plants (2: 41, 1888) I find, under *E. revolutum:* "Gathered by Menzies on Vancouver Island. Not lately detected unless this may be var. *albiflorum,* which turns pinkish in drying if young specimens are taken." Watson (1891) describes the species as white-flowered, and Piper in his Flora of Washington says: "We incline to the belief that the *E. revolutum* Smith, collected by Menzies on 'King George's Sound' is the plant here called *E. giganteum,*" never realizing that the pink *Erythronium* was common along the coast of his own state; and, following Macoun, Watson makes the startling statement that this plant is no longer found on Vancouver Island where Menzies' specimens were collected.

Howell (Fl. Nw. Am. 1903) seems to have had a correct understanding of the species. In Abram's Illustrated Flora of the Pacific States (1923), it is stated that the flowers are described as white. Aside from the statement that it is "like E.

californicum," the description in Jepson's Manual (1925)[2] is correct.

With reference to Watson's variety *Bolanderi,* mentioned above, the original description reads: "Usually low, 1–3- (rarely 4-) flowered; perianth white with yellowish centre, becoming rose-purple; appendages very prominent.—In the redwoods of Colusa, Mendocino, and Trinity Counties, California." In the Gray Herbarium are six sheets of specimens so labelled in the handwriting of Watson. In addition to having examined all of these sheets, I have explored, and collected *Erythronium* throughout the regions whence they came. Bolander's collection, "4709, Redwoods, Mendocino County, common," as suggested by Mr. Weatherby of the Gray Herbarium, in view of the name given by Watson, might reasonably be designated as the type. The type sheet holds one specimen each of *E. revolutum* Smith and *E. californicum* Purdy, two very distinct species, both common in the redwood region of Mendocino County. Three other sheets hold collections made in the vicinity of Weaverville, Trinity County, by Kleeberger in 1880. These are all clearly *E. californicum,* as is also another sheet, *Rattan 62,* Colusa County. A specimen of *E. revolutum* grown in Purdy's garden at Ukiah, Mendocino County, completes the list upon which Watson seems to have based his variety. *E. revolutum* does not occur anywhere on the east side of the Coast Ranges where the Kleeberger and Rattan collections were made. To add to the confusion, there are in the herbarium of the University of California and in the National Herbarium, duplicates of Bolander's "4709," an examination of which discloses the fact that *E. californicum* is not included. About ten years prior to the publication of his variety, Watson (Bot. Cal. 2: 170) notes: "The purplish variety, collected in the redwoods of Mendocino, (*Bolander,* n. 4709), is probably identical with the form of the plant described by Smith and first discovered by Menzies at Vancouver Island, and may prove distinct."

12. **Erythronium oregonum** sp. nov.

Cormus ca. 5 cm. longus, diam. 10–15 mm.; folia 12–15 cm. longa, 3–6 cm. lata, lanceolata vel oblongo-lanceolata, acuta, rarius oblanceolata, majora saepe oblongo-elliptica, apice saepe rotundata; petioli paululum late alati; scapi plerumque crassi, brunnescentes, 15–30 cm. alti, saepe altiores, uniflori vel pluriflori; alabastra plerumque rubescentia; perianthi segmenta 35–50 mm. longa, 8–12 mm. lata, late lanceolata, marginibus saepe sinuatis, apicibus longo-acuminatis, contortis, textura delicata, candida vel eburnea, basi extus punicea vel brunnescentia basi intus lutea, unilineata vel bilineata, lineis anfractis transversis, aurantiacis, atrorubescentibus vel atrobrunneis; segmentorum appendiculae plerumque quadrisaccatae, saccis inflatis conspicuis

[2] Jepson, W. L., A Manual of the Flowering Plants of California, 1925.

occlusis, lateralibus aliquandum minoribus vel etiam obsoletis, plicis auriculorum repositis; filamenta aliquantum dilatata, 1.5–2.5 mm. lata, subulata, plus minusve patentia, biserialia, jugis insolito inaequalibus; antherae aureae; stylus elongatus gracilis superne gradatim paullo ampliatus, diam. basi ca. 1 mm., apice 1.5 mm.; stigma bifidum, lobis filiformibus valde recurvatis, 4–5 mm. longis; capsula ca. 35 mm. longa, diam. 8 mm., angusti-obovoidea, retusa, in basin angustam aequaliter attenuata.

Type in the Dudley Herbarium of Stanford University, collected in the fir woods near and north of Oregon City, Clackamas County, Oregon, 23 April 1932, *Applegate 7086.* Dedicated to "Old Oregon" which included all of the territory within which the species is found. Oregon City was the early metropolis of Oregon and its territorial capital. There lived Dr. John McLoughlin, the "Father of Oregon"; and nearby, "in the continuous woods where rolls the Oregon," this beautiful plant occurs in great abundance.

A slender, more delicate form is common in the Puget Sound region and northward into British Columbia. The scapes are green, leaves not so strongly mottled, flowers pure white, segment base greenish without, light yellow within and beautifully marked with alternating, transverse, sharply angled zigzag bands of lemon-yellow and reddish-brown. This delicate plant usually occurs in the same localities as the typical stout form, but in separate colonies. It is commonly found in deep moist woods, in leaf-mold, moss and ferns. Of the typical form, the leaves in open situations are often very large, sometimes three inches broad and very strikingly mottled with three rows of dark-brown spots on each margin, with a large central dark area, separated by light green veins.

This species differs from *E. revolutum* Smith principally in the following particulars: strikingly in color of flowers, the white often turning pinkish instead of purplish; the flowers more numerous; the filaments narrower; the segments of the perianth broader, of more delicate texture, often with more slender twisted tips and more definite and contrasting basal markings.

Specimens collected. Oregon. Josephine County: Slate Creek, 9 April 1925, *4172;* 13 April 1925, *4229;* 24 April 1930, *6146;* 4 April 1931, *6640;* 20 April 1932, *7073.* Marion County: Jefferson, Santiam River, 23 April 1932, *7085;* Silverton, 24 April 1932, *7092.* Clackamas County: near Oregon City, 23 April 1932, *7086;* Marquam, 23 April 1932, *7091.* Curry County: Agness, 9 May 1932, *7104;* mountains south of Agness, 10 May 1932, *7115, 7117, 7120, 7123, 7154;* mountains north of Agness, 10 May 1932, *7169;* Lawson Creek, 14 May 1932, *7223;* Horse Sign Butte, *7227.* Washington. Pierce County: American Lake, 12 April 1931, *6659.* Thurston County: near Olympia, 12 April 1931, *6660.* Whatcom County: Bellingham, 14 April 1931, *6661.* Mason County: Purdy Creek, 23 April 1931, *6678.* British Co-

LUMBIA. Vancouver Island: near Duncan, 16 April 1931, *6662;* Royston, 17 April 1931, *6664;* Duncan, *6663;* Courtenay, 18 April 1931, *6667;* Qualicum River, 18 April 1931, *6668;* Nanaimo, 19 April 1931, *6669;* Saanich Inlet, 19 April 1931, *6670;* west of Victoria, 20 April 1931, *6672;* Victoria, 20 April 1931, *6673.*

Specimens examined. OREGON. Josephine County: Hayes Hill, 5 May 1923, *A. R. Sweetser* (UC); Slate Creek, 31 March 1926, *L. F. Henderson 5789* (UO, DH, CA); March 1928, *Mrs. Gale* (PhA); 5 May 1923, *Henderson* (PhA). Washington County: near Gaston, 1 April 1899, *Mabel Hazeltine* (UO); Forest Grove, 7 March 1916, *J. W. Thompson 540* (DH, PhA); 25 March 1894, *F. E. Lloyd* (NY). Multnomah County: Elk Rock, 17 April 1903, *Sheldon* (UO, DH); May 1892, *Fred Drake* (UO); 1918, *M. W. Gorman 4264* (DH); Portland, May 1918, *Gorman* (UO); Sandy, 21 April 1888, *Jessie Millard* (WS); Portland, *Dr. Nevius 873* (US); 6 April 1884, *Henderson* (GH); Sauvies Island, 1 April 1882, *Howell* (NY). Clackamas County: Oswego, 6 April 1889, *Henderson* (DH, UO); Clackamas, April 1896, *Thos. Howell 1554* (NY). Polk County: Monmouth, 2 May 1893, *W. J. Spillman* (WS). Benton County: Corvallis, 8 April 1929, *A. N. Stewart* (UM). Columbia County: St. Helens, *Howell* (UO); Scapoose Prairie, 10 May 1880, *Henderson* (UO); St. Helens, 1 April 1928, *J. W. Thompson 4009* (PhA); April 1882, *Thos. Howell* (PhA, NY). Marion County: Silverton, 15 April 1928, *J. W. Thompson 4097* (US, PhA, NY, DH, GH); Salem, 21 March 1915, *J. C. Nelson 9* (DH); near Salem, 16 April 1933, *Miss Hazzard* (US); near Jefferson, April 1918, *Estella Satchwell* (PhA); Jefferson, 18 April 1918, *M. E. Peck 7787* (GH); Salem, 14 April 1917, *J. C. Nelson 1042* (GH). Curry County: Game Lake, 27 June 1929, *Mrs. Leach 2329* (UO). WASHINGTON. King County: Seattle, 9 April 1889, *E. C. Smith* (WS, UC, DH); 4 April 1889, *Piper* (WS); 5 April, *Lois Clark* (UI); 24 August 1892, *C. A. Mosier* (US); April 1892, *Emma Shumway* (PhA, NY); near Palmer, April 1893, *C. A. Mosier* (NY). Pierce County: Tacoma, 25 April 1908, *Fleet 5432* (UC); 28 March 1896, *Fleet* (WS); 1894, *Gardner* (UC); 29 April 1929, *Lyman Benson* (DH); Steilacoom, *Dr. Kennicott* (NY). Clark County: Lake River, 12 April 1894, *Suksdorf 2327* (UC, UO, US, NY, GH). Clallam County: Sequim, May 1916, *J. M. Grant* (GH). Jefferson County: Hood Canal near Brinnon, 31 March 1931, *J. W. Thompson* (GH). Skamania County: Mt. Prindel, 26 May 1924, *Suksdorf 11714* (UC, DH, WS, CA, US, GH, PhA, NY). Klickatat County: 18 May 1882, *Thomas Howell* (NY). Skagit County: Pleasant Ridge, 13 April 1919, *Thos. Roush* (DH); Hat Island, 6 March 1926, *Edith Hardin* (WS); Whidby Island, 15 May 1897, *N. L. Gardner 289* (WS); Admiralty Head, April 1898, *Piper* (WS); Anacartes, 12 April 1925, *Ethel Hardin* (WS); Blanchard, 28 March 1931, *J. W. Thompson* (GH). Island County: Fidalgo Island, 25 April 1926, *Edith Hardin* (WS). Grays Harbor County: Wreck Creek

Prairie near Granville, June–July 1922, *H. S. Conard 427* (US, NY); *Capt. Wilkes Expedition, 1838–42, Puget Sound and interior, 364, 820* (US); Montesano, May 1919, *J. M. Grant* (NY). British Columbia. Vancouver Island: Victoria, 10 April 1912, *J. R. Anderson* (WS); Thetis Lake, 9 April 1909, *Anderson* (WS); Samilo Arm, 24 April 1905, *Anderson* (WS); Alberni, May 1913, *W. R. Carter* (PM); Dallas Road, 2 April 1899, *C. F. Newcomb* (PM); Highland Lake, 24 April 1921, *Miss D. Hill* (PM); Gordon Head, 27 April 1917, *M. Watson* (PM); Cedar Hill, 16 March 1915, *F. Kermode* (PM); Lost Lake, 21 April 1921, *J. R. Anderson* (WS); Victoria, *Mrs. Kelly* (CA); near Victoria, 2 April 1908, *John Macoun* (US, GH); May 1893, *John Macoun 5960* (US, GH); May 1881, *A. J. Hill a2635* (PhA); Cedar Hill, May 1887, *John Macoun* (GH); Alberni, May 1915, *W. R. Carter 1615* (GH); Renfrew District, 1 August 1902, *C. O. Rosendahl 1836* (NY); Cedar Hill, 16 April 1887, *John Macoun* (NY); near Victoria, 20 April 1918, *J. R. Anderson* (NY); 1874, *Miss Mitchell* (US). Mainland: Deadman River, 4 May 1918, *J. R. Anderson* (WS); Lower Frazer River, 1859, *Dr. Lyall* (GH).

Distribution: throughout the Transition Zone; southwestern Oregon, Josephine County, in the lower Applegate River region, and Curry County, in the mountains of the Rogue River; west of the Cascade Mountains, from central Oregon northward through northern Oregon, Washington, the mainland coast of southwestern British Columbia, and the east coast of Vancouver Island. Although occurring within the Columbia River Gorge as far as Cape Horn, it is never found east of the Cascade Range.

The following contacts with other species have been noted: with *E. revolutum* Smith at Courtenay, northeast coast of Vancouver Island, where many hybrids were noted; in Curry County, Oregon; in Josephine County, Oregon, with *E. Hendersonii* S. Wats. and *E. citrinum* S. Wats. The last is particularly interesting in that it is one of the few instances to come under my observation where three species were found intermingling; and also because of the striking results of hybridization in which all three species are involved. There were to be seen many singularly beautiful color forms combining the contrasting colors of *E. Hendersonii* with the white of the other two species, as well as exhibiting varied morphological and teratological combinations.

For nearly a century this familiar plant has been known erroneously as *Erythronium giganteum* Lindl. (Bot. Reg. sub pl. 1786. 1835); or as *Erythronium grandiflorum* var. *albiflorum* Hook. (Fl. Bor. Am. 2: 182. 1840).

The type of *Erythronium giganteum* Lindl. is in the Lindley Herbarium, which is included in the Cambridge Herbarium, Botany School, Cambridge, England. I am greatly indebted to Mr. W. T. Stearn, Librarian of the Lindley Library of the Royal Horticultural Society, Westminster, for a photograph of the type

sheet. I also have from him his drawings and measurements of the original, together with his notes on a critical examination of the same which he kindly made for me. Of the drawings and measurements, the most significant are those of the filament, 1 mm. wide at the base. The type sheet holds two specimens. The first is a plant *branched at the leaves,* one with two, the other with three flowers. This specimen is labelled "Type *Erythronium giganteum* Lindl. Botanical Register 1786. (1836)," and in Lindley's handwriting (according to Mr. Stearn) "Eryth. giganteum B. Reg. 1786. N. W. America Douglas 1826." Referring to his journal for the year 1826, we find that Douglas spent the early part of the year at Ft. Vancouver with Dr. McLoughlin, Chief Factor of the Hudson's Bay Company. From the 1st to the 20th of March it rained every day, during which time he was engaged in packing boxes of specimens to be shipped to England. It does not seem that he did any plant collecting during this time other than some mosses which he mentions. Indeed, ordinarily this was too early in the season for most flowering plants. Late in the afternoon of March 20th, he left Ft. Vancouver by boat with a Hudson's Bay Company trapping expedition bound for the upper Columbia region. There was no opportunity for collecting until he was long past the easternmost limits of the range of the white-flowered plant heretofore known as *Erythronium giganteum* Lindl. or *Erythronium grandiflorum* var. *albiflorum* Hook., and well within that of the yellow-flowered *Erythronium grandiflorum* of Pursh. On this journey Douglas' plants were numbered consecutively, beginning with number one. On April 27th, at Kettle Falls (Ft. Colville), he collected his number 37, which he identified as *"Erythronium grandiflorum* of Pursh." He remarks that "this exceedingly beautiful plant came under my notice fifteen or sixteen days ago, but being not then in blossom I took it for *Fritillaria;* abundant over all the undulating country, under the shade of solitary pines, in light dry soils; it has a most splendid effect in conjunction with *Dodecatheon* and a small species of *Pulmonaria;* omit not to procure seed and roots of such a desirable plant." There appears to be no evidence to indicate that Douglas made any other flowering collections of *Erythronium* during the year 1826.

Plate 1786, volume 21, Botanical Register, 1836, shows a plant with golden-yellow flowers, unmottled leaves, slender filaments and red anthers. This is clearly typical *Erythronium grandiflorum* Pursh. Following the description of this species, appearing as a footnote, is the original publication of Lindley's *Erythronium giganteum.* The two line Latin description could just as well apply to almost any other species. In his remarks accompanying his diagnosis, he says that it "is most remarkable for having *an irregularly branched scape."* So that his species seems to have been based primarily upon its manner of branching. The type specimen is a "sport" to begin with, branching as

it does *at* the leaves instead of the usual way, more or less distantly *above* the leaves. The only excepion to this rule is the California species *E. multiscapoideum* (Kell.) Nelson & Kennedy. Four years later W. J. Hooker in reducing Lindley's species to a variety of *E. grandiflorum,* characterizes it as having 2 to 5 *yellow* flowers, habitat the "Summit of the low hills near the junction of Spokan River with the Columbia, and in the vallies west of the Rocky Mountains, often in blossom before the snow has disappeared. *Douglas.*" This publication of Hooker's further bears out the assumption that the type of *E. giganteum* was collected by Douglas in the Kettle Falls region.

As discussed in this paper under *Erythronium idahoense* St. John & Jones, Geyer refers to Douglas' collection (in conjunction with his own botanizing in the same region in 1844), as a "bright golden-yellow species with brown anthers," which sufficiently identifies the plant as typical *E. grandiflorum* Pursh.

The second species held by the Lindley type sheet seems specifically identical with the type specimen. This bears four flowers, and is labelled "No. 49. *Erythronium giganteum.* Near the Koutani River, lat. 49′ 20″, elevation 3400 ft. Growing in the crevices of granite rocks." In 1827, coincidentally, we find Douglas leaving Ft. Vancouver on the same day of the month as his departure the previous year. To quote his journal: *"March 20th*—By the annual express and in company with Dr. McLoughlin, I left Ft. Vancouver for England. . . . I walked the whole distance from this place to Ft. Colville on the Kettle Falls, which occupied twenty-five days. . . . The beautiful *Erythronium maximum* and *Claytonia lanceolata* were in full bloom among the snow." Under the date of 13th to 17th of April: "Gathered a few bulbs of *Claytonia lanceolata, Lilium pudicum,* and roots of *Erythronium grandiflorum.*" And April, *"Thursday, 19th.* Near McGillivary's or Cootania River. Of herbaceous plants *Ranunculus* sp., *Claytonia lanceolata,* and *Erythronium grandiflorum* in flower; a few of the latter I laid in."

That *Erythronium giganteum* Lindl. is synonymous with *Erythronium grandiflorum* Pursh, there is no longer any doubt. The establishment of the type locality alone is sufficient to remove any doubt, even without the identity of the specimen itself, along with the corroborative circumstances heretofore recited.

Discarding the name *E. giganteum,* the only possible name available would be *E. grandiflorum* var. *albiflorum* Hook. This Hooker describes: "caule elatiori unifloro, flore albo." He does not state whether or not he had before him the "white-flowered" plant upon which he based his variety, nor does he give any other information which might lead to the identity of a type.

In 1868, J. D. Hooker (Bot. Mag. pl. 5714) published a fine colored plate showing clearly the plant here discussed. He refers it to *E. giganteum,* and assumes that it is the same as *E. grandiflorum* var. *albiflorum* Hook. Concerning the original of

the plate, Hooker says: "It is a native of North-west America, and was communicated from the Edinburgh Botanic Garden in April of the present year." He further states: "*E. giganteum* was discovered by Douglas, who does not notice the colour of the flower, nor does Lindley, in his diagnosis of it above quoted. They would appear to be white in Douglas' own specimens preserved in the Hookerian Herbarium, but in the 'Flora Boreali-Americana' they are stated to be yellow; and another variety is noticed as having white flowers (viz. δ. *albiflorum*), to which the present plant no doubt belongs." This does not clear up the identity of the variety *albiflorum*. Hooker seems to have only assumed that Douglas' herbarium specimens had always been white, when they probably were originally yellow; so that there is no evidence to indicate that the variety was not based upon the same material as the type.

Following Hooker's descriptions (Fl. Bor. Am. 2: 182. 1840). of his varieties of *Erythronium grandiflorum* Pursh (*minor, giganteum, albiflorum,* and *Smithii*), is an account of their habitats in which confusion is caused by an error due to an apparent misprint in the text. This is referred to by Sir Arthur W. Hill in his letter accompanying the types *E. revolutum, E. grandiflorum* var. *giganteum* and *E. grandiflorum* var. *albiflorum* sent to me from Kew; concerning which he says: "It has been very difficult to decide which are the type specimens of Hooker's varieties of *E. grandiflorum,* since he did not write them up himself, and they have since been wrongly written up (*e.g. E. grandiflorum* var. *revolutum* Hook., which does not exist) by other botanists. The type of var. *albiflorum* was not collected by Menzies at Ft. Vancouver, but by Douglas. The plant collected by Menzies was the type collection of Smith's *E. revolutum;* it was a purple-flowered plant, and was named var. *Smithii* by Hooker in Fl. Bor. Am. 2: 182. The erroneous application of Menzies' name to variety *albiflorum* is apparently due to a misprint in the text of Fl. Bor. Am. 2: 182. Here, in the accounts of the habitats, "α" is repeated, and var. "δ" does not appear at all. It is clear that the first "α" applies to var. *minor,* the second "α" applies to var. "β" *giganteum,* "β" applies to var. "γ" *albiflorum,* and "γ" to var. "δ" *Smithii.* This fits in with the rest of the evidence, and with the herbarium specimens, and it is evident that vars. *giganteum* and *albiflorum* were collected by Douglas, and var. *Smithii* by Menzies."

It therefore necessarily follows that the types of both vars. *giganteum* and *albiflorum* were collected "near the junction of the Spokane River with the Columbia," and that the first was yellow and the second was white; in which case var. *albiflorum* could be nothing else but *E. idahoense* St. John & Jones, since it is the only white-flowered species in all the region east of the Cascade Mountains, and obviously not the white-flowered species occur-

ring west of this range, and known so long as *E. giganteum* Lindl. or *E. grandiflorum* var. *albiflorum* Hook.

I have before me a sheet of plants from Kew purporting to hold the types of Hooker's varieties *giganteum* and *albiflorum* of *E. grandiflorum* Pursh. Attached to this is what appears to be an original label in the handwriting of Douglas reading: *"Erythronium maximum.* On the summit of the low hills, near the junction of Spokane river and vallies of the Rocky Mountains. 1826." This is identical with that of the collection in the Lindley Herbarium which is the basis of *E. giganteum* Lindl. and, as I have long suspected, doubtless a part of the same collection. To this Kew sheet from time to time various annotations have been made, apparently representing the guesses of other botanists as to the identity of the plants. Of these, the latest designate the types of Hooker's varieties *giganteum* and *albiflorum,* and are dated 1934. The first name is written under a three-flowered specimen, the second under a two-flowered one. Above this last is the third specimen of the sheet under which is written: "Ft. Vancouver, Tolmie." This has only a single flower which corresponds to the number in Hooker's description of his variety *albiflorum,* all of which does not tend to clarify matters concerning the identity of variety *albiflorum.* All of the plants on the sheet look to me like *E. grandiflorum* Pursh, just as I think they did to Douglas himself, his manuscript name *E. maximum* being a synonym of that species. In the condensed report of his two journeys through the Spokane country, Douglas uses the name *E. maximum,* while in the long account expanded from this, he names the same collections *E. grandiflorum.*

12a. Erythronium oregonum subsp. **leucandrum** (Applegate) comb. nov. *Erythronium giganteum* subsp. *leucandrum* Applegate, Contr. Dudley Herb. 1: 189. 1933.

Apparently this subspecies differs from the species only in having white anthers instead of golden-yellow ones.

Type in the Dudley Herbarium of Stanford University, no. *207816;* collected in low brushy foothills, in open yellow pine and oak woods, near the mouth of Evans Creek, Rogue River, western edge of Jackson County, Oregon, 8 April 1925, *Applegate 4161.*

The following additional collections were made by myself: Jackson County: near Prospect, 29 April 1930, *6147* and *6148.* Josephine County: near and north of Grants Pass, *6648;* Grave Creek, *6639;* Wolf Creek, 2 April 1931, *6637.* Douglas County: Cow Creek, *6636;* Canyon Creek, *6635;* Myrtle Creek, *6634;* 13 miles south of Roseburg, *6633;* near Oakland, 6 April 1931, *6650;* near Yoncalla, *6651;* near Drain, *6652.* Lane County: near Eugene, 6 April 1931, *6652a.* Coos County: north fork of the Coquille River, 31 March 1931, *6631.*

Specimens examined. Oregon. Lane County: Eugene, 4 April 1905, *Sheldon* (UO); near Eugene, 1 April 1907, *Elsie Davis* (PhA). Douglas County: Drain, *Sheldon* (UO); Canyon Creek, 27 March 1929, *Lyman Benson* (DH); near Canyonville, 28 April 1928, *Mrs. Gale 48* (DH, PhA); near Elkton, 1900, *F. H. Andrus 59* (US, NY); Cow Creek Canyon, 8 April 1887, *Thos. Howell* (GH). Josephine County: Grants Pass, 1 April 1899, *Howell* (UC); Louse Creek, April 1913, *Lois Dale* (DH); Sexton Mountain, 7 April 1927, *J. W. Thompson 2061* (DH); Woodville, 11 April 1889, *Jos. Howell* (PhA); 4 miles north of Grants Pass, 12 April 1933, *M. S. Baker 7357* (DH). Jackson County: Wimer, Evans Creek, 24 April 1893, *E. W. Hammond 388* (CA, NY, US).

Distribution: common throughout the Transition Zone; between the Cascade Mountains and the Coast Range from central Oregon southward to the Rogue River; occasionally found west of the summit of the mountains of the coast in Lincoln and Benton counties, and perhaps in Douglas County. Dr. Helen M. Gilkie of the Department of Botany, Oregon State College, reports this form as far north as Beaverton, Washington County; and Professor L. F. Henderson of the University of Oregon writes me that he has seen the typical form in Lane County. Thus it will be seen that the two overlap for about one hundred miles. However, the occurrence of each at the outer edges of their limits is rare. The species in typical form occurs from Benton and Linn counties northward, while from Lane County southward it is seldom seen. While both forms are found in the central part of the state, they seem to occur in separate colonies. Although the white-anthered form has not been reported from Marion County, the occasional occurrence of individuals with purple anthers in the southern part of that county suggests the probability of contacts, since a change in anther-color is one of the common results of hybridization in the genus.

Erythronium oregonum subsp. *leucandrum* is extremely abundant over much of the range above outlined, and especially so in the open, wooded hills of Douglas and northern Josephine and Jackson counties. In the southern part of the range this subspecies is associated with *E. Hendersonii* S. Wats., where interspecific hybrids are common.

13. Erythronium californicum Purdy, Flora and Sylva 2: 253. 1904. *Erythronium revolutum* var. *Bolanderi* S. Wats. Proc. Am. Acad. 26: 129. 1891, for the most part (see *E. revolutum* Smith).

Corm rather large, with conspicuous membranous coats; leaves strongly mottled with dark green to brownish irregular areas separated by light colored veins, 10–15 cm. long, 2.5–5 cm. broad, from oblong-lanceolate or oblong-ovate to oblong, the larger commonly rounded at the apex and sometimes ob-

lanceolate, the smaller acute to acutish, petiole short and broadly winged; scape 10–25 cm. high (or higher), frequently stout, often reddish in color, bearing usually one to three flowers, often several, when frequently the pedicels arise from a common point above the leaves; flower buds often reddish or brownish; the perianth segments broadly lanceolate with blunt and often cuculate apices 25–35 mm. long, 7–10 mm. broad, white to creamy-white, shading at the base into pale greenish yellow, usually marked transversely by an irregular, continuous or interrupted band of deeper yellow, orange, or sometimes brown, the edges of the color zones indefinite; filaments slender and of nearly uniform width throughout; anthers white; style rather stout but slender at base, moderately clavate, 8–10 mm. long; stigma lobes commonly short (1–2 mm.), stoutish, erect or spreading, infrequently longer and more or less recurved; ovary often pinkish; capsule rather narrowly obovoid with rounded apex.

This plant was formerly confused with the northern *E. oregonum* Applegate, but it is easily distinguished from that species by its slender filaments, shorter and stouter style, shorter, thicker and more erect stigma lobes, and less striking perianth segment markings. The two species are separated geographically by about 75 miles, and topographically by the Klamath River Gap and the Siskiyou cross range of mountains. The intervening territory is occupied by the "Siskiyou Island" endemics, *E. citrinum, E. Hendersonii,* and *E. Howellii* (all described by S. Watson). There is an intrusion of *E. klamathense* Applegate along the summit of the Siskiyou Mountains and locally at the north end of the Trinity Mountains. *Erythronium grandiflorum* var. *pallidum* St. John occurs on the higher points of the two last mentioned ranges. *Erythronium californicum* Purdy is associated with *E. revolutum* Smith along the coast of Mendocino and Humboldt counties, and in southern Lake County in separated from *E. helenae* Applegate by Cobb Mountain.

Distribution: common in upper Sonoran and Transition zones of the Coast Ranges and adjacent foothills of Sonoma, Mendocino, Lake, Colusa, Glenn, Tehama, Trinity, Shasta, and Humboldt counties, California. Ranging from near sea level to above 2500 feet.

Described from plants collected by Purdy in the vicinity of Ukiah, Mendocino County, California.

Specimens collected. California. Mendocino County: near Laytonville, 27 March 1931, *6623;* near Cummings, 5 April 1933, *8306.* Lake County: hills west of Kelseyville, 24 March 1931, *6611;* Scotts Valley, 25 March 1931, *6612;* hills west of Lakeport, 25 March 1931, *6620;* near Pine Grove, north base of Cobb Mountain, 31 March 1934, *8872;* Hopland grade, 31 March 1934, *8878.* Tehama County: near Bennett Spring, 6 April 1930, *6115;* Mud Flat, *6118.* Glenn County: below Alder Spring, 17 April 1930, *6122;* near Begum, Bully Choop Mountains, 13 April

1932, *7046*. Shasta County: near Begum, 13 April 1932, *7045*. Trinity County: near Weaverville, 14 April 1932, *7050;* Fawn Lodge, Trinity Mountains, *7055*.

Specimens examined. California. Trinity County: Weaverville, 2 May, 30 May, and 30 June (fruit) 1880, *G. R. Kleeberger* (GH, cotype *E. revolutum* var. *Bolanderi* S. Wats., CA); near Weaverville, 22 April 1915, *Anna Junkans* (CA). Shasta County: Redding, 3 April 1922, *Ruth Carredet* (CA). Glenn County: Newville-Covello road, 27 April 1916, *Heller 12342* (CA, PhA, NY, GH, US). Lake County: near Bartlet Spring, 6 May 1928, *Carl Wolf 1976* (DH); 6 May 1928, *L. R. Abrams 12388* (DH); Lakeport, April 1917, *G. Bentley* (DH); High Valley, April 1902, *Agnes Bowman* (DH); road to Mt. Sanhedrin, 25 May 1925, *Alice Eastwood* (CA); Mt. Sanhedrin *Eastwood 12963* (CA); between Hopland and Lakeport, 12 May 1903, *C. F. Baker 3202* (US, GH); Scotts Valley, 23 March 1930, *Lyman Benson 1962* (GH); Mt. Sanhedrin, 29 May 1927, *Bacigalupi* (DH); Colusa County: Black Butte, June 1882, *V. Rattan* (GH, cotype). Sonoma County: Cloverdale, 25 June 1877, *Rattan* (DH); Gualala River, *M. S. Baker* (DH, UC); near Healdsburg, May 1880, *Rattan* (GH); Cloverdale, 15 March 1898, *Setchell* (UC, GH). Mendocino County: 1866, *Bolander 4709* (GH, in part type of *E. revolutum* var. *Bolanderi* S. Wats.); Ridgeway highway, 1 April 1928, *Doris Kildale 4373* (DH); Yorkville, May 1922, *Hall Burgess* (DH); Mt. Sanhedrin, 1884, *Rattan* (DH); Sherwood Valley, 17 June 1899, *Blasdale* (DH); 29 May 1899, *Blasdale 1043* (UC); Rowes, 11 May 1902, *Chandler 1055* (UC); Potter Valley, April 1894, *Congdon 880* (UC); Ukiah, 10 March 1925, *Billie Held* (CA); Ukiah, April 1929, *Vivian Giles* (CA); May 1876, *Jos. Clark 201* (NY); near Handley's, May 1903, *Jas. W. McMurphy 176* (NY, US); near Ukiah, 23 March 1902, *Alice Eastwood* (NY, US); 1895, *Carl Purdy* (GH). Humboldt County: McClellan Mountain, 1 May 1928, *Doris Kildale 5983* (DH); Kneeland Prairie, 21 March 1926, *Doris Kildale 1579* (DH); 4 May 1913, *Tracy 4058* (UC, US); Harris, 15 April 1906, *Ethel Tracy* (UC); near Hoopa, March-April 1902, *Mrs. Manning* (UC); Willow Creek, 27 April 1924, *Tracy 6639* (UC); between Three Creeks and Willow Creek, 30 April 1922, *Tracy 6037* (UC); Hoopa Valley, April 1888, *C. C. Marshall* (UC).

14. Erythronium helenae Applegate, Contr. Dudley Herb. 1: 188. 1933.

Corms large (6–8 cm. long, 10–15 mm. thick), propagating by sessile offsets, or by very short runners, forming under favorable conditions, compact clumps, the filiform roots produced in a large dense mass; leaves strongly mottled, varying in outline from ovate or elliptical to oblong-lanceolate or lanceolate, and obtuse to acute, the base narrowing either abruptly or attenuately to a winged petiole; scape commonly about 2 dm. high or

higher, abruptly bent at right angles close up to the flower; flowers one or more, large and showy, the segments 35–40 mm. long, 10–15 mm. broad, usually broadly lanceolate with blunt and cuculate apex, the upper part pure white (the outer set sometimes more or less streaked with pink on the back), the base golden-yellow without spots or bands of any kind, the color areas very definite, the two median appendages slightly elongated inflated sacs, the auricles transversely folded to form a slight connecting ridge; filaments slender with little or no taper, shorter than the young anthers, these golden-yellow; style but little enlarged above, usually strongly declined or gradually and completely curved downward; stigma lobes short, stout, entire, and erect to spreading; capsule 15–20 mm. long, 8–10 mm. thick, truncate, the angled sides cuneate in outline.

Type in the Dudley Herbarium of Stanford University, collected in the volcanic crater region of Mt. St. Helena, Mayacama Range, northern Napa County, California, on very steep wooded northerly slope, in well watered volcanic soil and leaf mould, 4 April 1932, *Applegate 7037*. Other collections have been made by myself as follows: the same station as the type, 22 March 1932, *7031;* Gallagher's ranch, north base of Mt. St. Helena, southern Lake County, 23 March 1931, *6610,* 21 March 1932, *7029* and 1 April 1933, *8302;* near and north of Gallagher's ranch, 11 March 1934, *8841;* St. Helena Creek, Napa County, near Lake County line, 11 March 1934, *8842;* west slope of Mayacama Mountains above Pine Flat, Sonoma County, *8855;* east slope of Mayacama Mountains, Putah Creek, Lake County, 31 March 1934.

Specimens examined. California. Napa County: Oat Hill, March 1900, *Miss Armstrong* (UC); Pope Valley, 1 March 1921, *Mrs. Clara Hunt,* 10 March 1924, *Mrs. Hunt* (CA). Lake County: Mt. St. Helena, 20 April 1892, *E. L. Greene* (NY); Middletown grade, Mt. St. Helena, 15 May 1893, *W. L. Jepson* (US); St. Helena Creek, 4 April 1931, *D. D. Keck 1087* (PhA, GH); Mt. St. Helena, 10 March 1925, *Jessamine Raymond* (CA); Mt. St. Helena, 27 March 1927, *Elizabeth Wright* (CA); St. Helena Creek, 21 March 1926, *J. T. Howell 1715* (CA).

Perhaps our most local species, unless it be *E. tuolumnense* Applegate of the Sierra Nevada, little more than one hundred miles to the east. Found only in the northwest corner of Napa County, the southwest border of Lake County, and the northeast corner of Sonoma County; confined to the Mayacama or Middle Coast Range, the central and culminating point of which is Mt. St. Helena, and extending from the Crater or Palisades region (lying between Calistoga and Pope Valley, Napa County), northwesterly, along the boundary line between Lake and Sonoma counties to the south slope of Cobb Mountain, the upper waters of Putah Creek, and Pine Flat, upper Sulphur Creek region on the west. As far as I know this is the only *Ery-*

thronium in Napa County. From the north base of Cobb Mountain and the canyon of Sulphur Creek to the west, *Erythronium californicum* Purdy is common northward, but the two species seem definitely separated by these natural boundaries.

Resembling *E. californicum* Purdy, but differing from that species particularly in having bright yellow anthers instead of white ones, perianth segments with clear-cut color areas instead of mixed and indefinite ones, and by the habit of producing clumps of corms by sessile offsets. A strikingly beautiful and responsive plant in cultivation. In the garden the stimulation of the growth of corm offsets is especially noticeable, clumps of as many as one hundred being produced in a few years.

15. Erythronium multiscapoideum (Kell.) Nelson & Kennedy, Muhlenbergia 3: 137. 1908. *Fritillaria multiscapoidea* Kell. Proc. Calif. Acad. 1: 46. 1855. *Erythronium grandiflorum* var. *multiscapoidea* A. Wood, Proc. Phila. Acad. 1868: 166. *Erythronium Hartwegii* S. Wats. Proc. Am. Acad. 14: 261. 1879.

Corms very short, about 10 mm. long, 5 mm. thick, oblong-ovoid, producing new ones from the base very freely on the ends of long filiform offshoots or runners; leaves commonly oblanceolate, acute (the larger sometimes obtuse), narrowed to a short, winged petiole, occasionally alternate, sometimes with a third leaf and, rarely, with four; flowers usually solitary, otherwise borne on naked elongate umbellate pedicels of unequal length, branching from the stem at the leaves, sometimes a pedicel branching and bearing a second flower on a short subpedicel, or rarely the pedicels branching at some distance above the leaves as in the other species; perianth segments white to greenish-white or creamy-white with pale greenish-yellow base, the center of this area sometimes darker, lanceolate to oblong-lanceolate, the apex commonly blunt and more or less cuculate, 25–40 mm. long, 7–12 mm. broad; appendages often not well developed, sometimes with four small somewhat inflated sacs, the lateral ones occasionally reduced to a ridge-like fold, or all four represented by a continuous ridge and the auricles appearing only as a slight widening of the base; filaments about 5 mm. long, thin and filiform, nearly uniform in width (less than 1 mm.); anthers white, 8–10 mm. long before dehiscence; style slender, slightly clavate, about 8 mm. long, 1 mm. or less thick; stigma very deeply cleft, filiform, lobes entire, strongly recurved, often forming a complete circle; capsule relatively short, oblong-ovoid, about 10 mm. long, 5 mm. thick.

Relative to the length of the style, the stigma lobes are longer than those of any other species. Sometimes the filament lengths of the two sets are nearly the same; rarely the young anthers vary slightly in length. The flowers are very fragrant. The habit of producing runners is not shared by other western species; the small, short corms are much like those of the

eastern and the old world species, and produce offsets in the same manner as *E. americanum* Ker.-Gawl. and *E. albidum* Nutt., two of the eastern species. Our plant resembles the latter more closely in its divided stigma with recurved lobes, but differs from that species in being provided with inner-segment processes. The inflorescence is unlike that of any other known species.

Distribution: Transition Zone; wooded bank of the Sacramento River in the northwest corner of Butte County; Digger and yellow pine woods of the foothills of the Sierra Nevada from southeastern Tehama and Butte counties, southward to Mariposa County, California. More often found on brushy hillsides in the regions where Digger and yellow pines overlap.

The type collection, sent in 1855 from Placerville, Eldorado County, California, to Dr. Albert Kellogg, California Academy of Sciences, if preserved in the first place, was destroyed by the earthquake and fire of 1906. In describing the plant as a "Fritillaria" Dr. Kellogg suggested that it would "ultimately require a new genus."

In publishing the new combination in recognition of Kellogg's specific name, Nelson and Kennedy erroneously included as a synonym *E. purpurascens* Wats. rather than the true synonym *E. Hartwegii* Wats. This confusion doubtless arose from the fact that both species were collected in the same region, and from Watson's treatment of the synonomy of the two plants. The type of *E. Hartwegii* was collected by Theodore Hartweg (288) under the auspices of the London Horticultural Society (Jour. Lond. Hort. Soc. 3: 221. 1848), in the latter part of April, 1847, in yellow pine woods of the foothills of the Sierra Nevada, near Pine Creek, in what is now southeastern Tehama County, California. The following year Bentham (Pl. Hartw. 339, No. 1989), not recognizing the plant as new, referred it to *E. grandiflorum* Pursh. Curiously enough, in his original publication, Watson included both *Fritillaria multiscapoidea* Kell. and *E. grandiflorum* var. *multiscapoidea* Wood in the synonomy of *E. purpurascens,* thus confusing two of his own species.

In the narrative of his Pacific Coast trip of 1866 (Proc. Phila. Acad. 1868: 166), Dr. Alfonso Wood records having seen in the Torrey Herbarium a collection from the Sacramento Valley by Dr. Stillman. To this collection he gives the name *E. grandiflorum* var. *multiscapoidea,* with "Scapes several, all radical, each 1-flowered." This description sufficiently characterizes Dr. Kellogg's "Fritillaria." The Stillman collection came under my observation recently in an examination of the *Erythronium* material in the herbarium of the New York Botanical Garden which includes the Torrey Herbarium.

From the foregoing account it will be seen that Dr. Wood was the first to recognize the plant as an *Erythronium,* and the first to apply Kellogg's name to the right species. Dr. Abrams

in "The Illustrated Flora of the Pacific States," was the first to publish the correct alinement under the new combination.

Specimens collected. CALIFORNIA. Eldorado County: near American River between Coloma and Auburn, 28 April 1929, *5551*. Nevada County: Grass Valley, 30 April 1929, *5552;* American Ranch Hill, near Grass Valley, 30 April 1929, *5554*. Yuba County: 5 miles north of San Juan, north fork of Yuba River, 1 May 1929, *5555*. Mariposa County: 8 miles northwest of Mariposa, 18 March 1931, *6608*. Butte County: 12 April 1932, near Cana, Sacramento River, *7041*.

Specimens examined. CALIFORNIA. Butte County: Los Verjils, 24 April 1920, *Junea Kelly* (CA); Rock Creek north of Chico, 19 March 1915, *Heller 11774* (CA, DH, PhA, NY, US, GH); 12 April 1889, *Miss Patterson* (DH); Butte Creek, May 1898, *Mrs. Bruce 2011* (DH, NY, US); March 1899, *Mrs. Austin* (UC); Chico, 1883, *Mrs. Austin* (US); Little Chico Creek, 6 March 1883, *Mrs. Austin* (GH); Chico, April 1879, *Mrs. J. Bidwell* (GH). Plumas County: 1875, *Mrs. M. E. P. Ames* (GH). Sierra County: Downieville, 15 April 1928, *Wm. Vortriede* (CA); Forest City, May 21 1854, *J. M. Bigelow, Whipple Expedition* (NY). Tehama County: near Pine Creek, April 1847, *Hartweg 288* (NY, isotype, GH, type). Eldorado County: Kelsey 21 April 1883, *M. E. Jones* (CA, NY); between Eldorado and Placerville, 7 April 1911, *Heller 12301* (CA, DH, GH, PhA, NY, US); Placerville, May 1923, *Alice King* (CA); near Georgetown, 26 March 1927, *Eastwood 14186* (CA); near Placerville, 13 April 1929, *G. T. Benson* (DH); Nashville, 7 April 1902, *G. P. Rixford* (US, GH, NY); Coloma, *Maj. Rich* (NY). Yuba County: Smartsville, April 1921, *Mrs. D. C. McGanney* (CA, GH); Brownsville, 1880, *Rattan* (DH). Mariposa County: near Mariposa, 21 April 1929, *Ivan Branson* (CA, UC); April-May, *Congdon* (UC); 15 April 1895, *Congdon* (UC, DH, UO); Mt. Bullion, May 1905, *Mrs. Chas. Derby* (UC); Benton Mills Trail, 8 April 1893, *Congdon* (DH). Placer County: Auburn, 20 April 1919, *Georgia Bentley* (DH); Auburn, 5 April 1891, *Sonne* (UC); Auburn, 1860–67, *Bolander 4527* (UC, US, GH). County not given: "Valley of the Sacramento," 1850, *Dr. Stillman* (NY); *Thos. Bridges 332* (US, NY, GH); 1880, *C. C. Parry* (US).

Dudley Herbarium, Stanford University,
February 7, 1935.